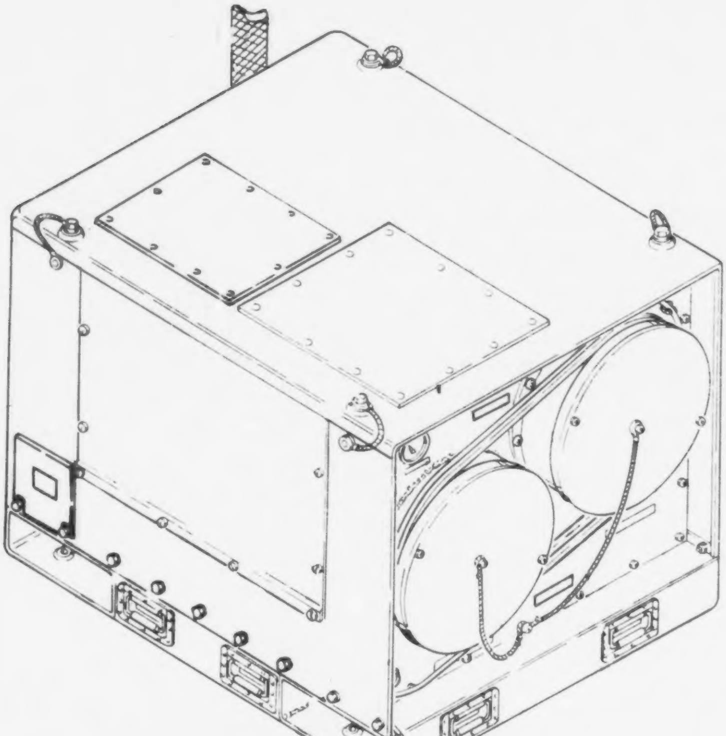
5-4520-256-14

OPERATOR'S, UNIT, INTERMEDIATE DIRECT SUPPORT AND INTERMEDIATE GENERAL SUPPORT MAINTENANCE

HEATER, DUCT TYPE, PORTABLE, HDU-36/E, 120,000 BTU, MODEL H82



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HEADQUARTERS, DEPARTMENTS OF THE ARMY
AND THE AIR FORCE

5 AUGUST 1988

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WARNING

Do not smoke or use an open flame in the vicinity of the heater unit when servicing the fuel tank. Failure to comply may result in personnel injury.

A hot shutdown occurs when the heater and centrifugal fan are turned off at the same time when in heater mode. Avoid turning off the fan and heater at the same time. Always set the OFF/VENT/HEAT switch to VENT for at least 3 minutes when shutting down the heater unit from heating mode. Failure to comply may damage heater and under some conditions, it is a safety hazard.

If a power failure occurs when the heater is firing, immediately set the OFF/VENT/HEAT switch selector switch (S1) to OFF. Disconnect both the return and supply air ducts from the shelter and turn parallel to the heater unit duct outlets. If available, insert the nozzle of a CO2 fire extinguisher in the supply air duct and discharge CO2 in short blasts of one or two seconds for six to ten blasts.

Steel banding, cut under tension, can snap free and cause injury. Leather gloves and face shield are required.

Be careful when working with live electrical circuits to prevent contacting electrical voltages which could cause death or serious injury. Personnel should stand on "High Voltage" switchboard netting (Federal Specification ZZ-M-81A), 3/16 inch (4.8 mm) or greater, to avoid being grounded.

Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well ventilated area.

Always place green wires onto plug to match the ground blade of the plug. Failure to do so can result in serious injury or death during equipment set up and operation.

Paints are flammable. Use only in a well-ventilated area and remove all possible sources of ignition to prevent potential injury.

TM 5-4520-256-14
T.O. 35E7-6-26-1

TECHNICAL MANUAL

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 5 August 1988

OPERATOR'S, UNIT, INTERMEDIATE DIRECT SUPPORT AND INTERMEDIATE GENERAL SUPPORT MAINTENANCE MANUAL FOR HEATER, DUCT TYPE, PORTABLE, HDU-36/E, 120,000 BTU MODEL H82

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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, U.S. Army Troop Support Command, ATTN: AMSTR-MCTS, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798 (Army); or AFTO Form 22 to: WR-ALC/MMEDT; Robins AFB, GA 31098 (Air Force). A reply will be furnished to you.

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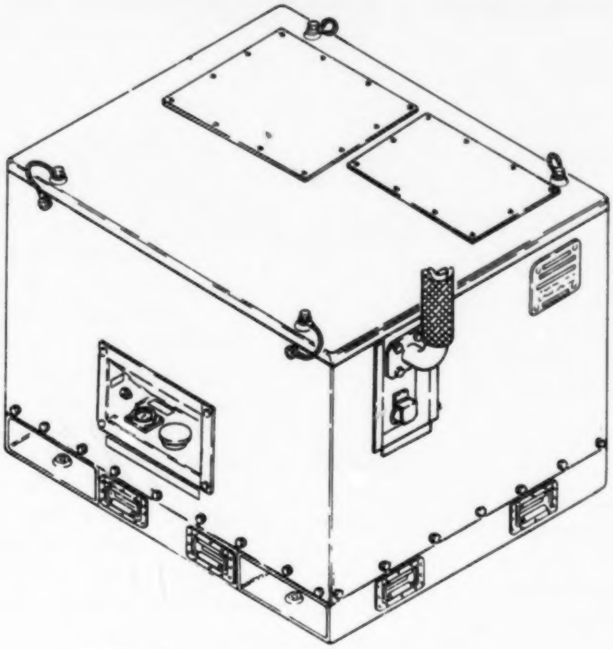
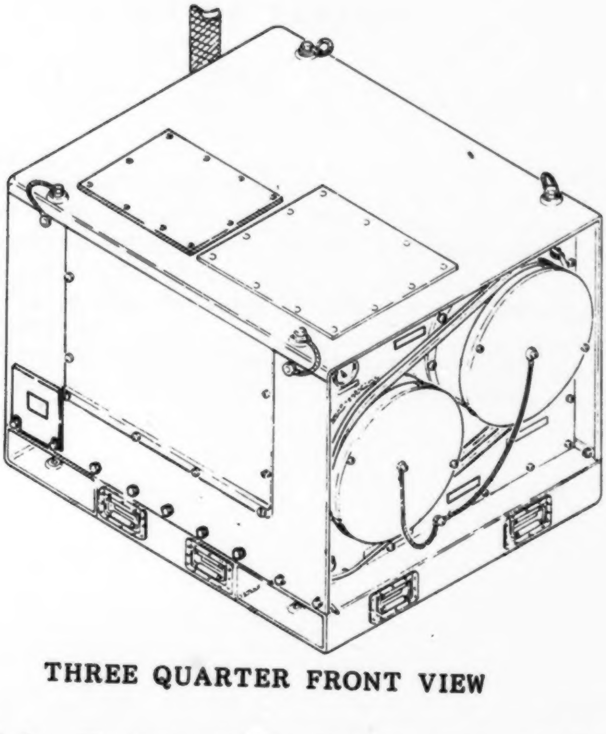


THREE QUARTER REAR VIEW



THREE QUARTER FRONT VIEW

Figure 1-1. Heater, 120,000 BTU, Type HDU-36/E.

CHAPTER 1

INTRODUCTION

Section I. GENERAL INFORMATION
Section II. EQUIPMENT DESCRIPTION
Section III. TECHNICAL PRINCIPLES OF OPERATION

Section I. GENERAL INFORMATION

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1-1. SCOPE.

a. Type of Manual. This manual is an Operator's, Unit, Intermediate Direct Support, and Intermediate General Support maintenance manual.

b. Model Number and Equipment Name. The official equipment name is the Heater, Duct Type, Portable, HDU-36/E, 120,000 BTU Model H82. Hereafter, it will be referred to as the heater unit.

c. Purpose of Equipment. Designed for heating and ventilating the transportable shelters used in the Bare Base Equipment System.

1-2. MAINTENANCE FORMS AND RECORDS. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA Pam 738-750, The Army Maintenance Management System.

1-3. DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE. Refer to TM 750-244-3 for instructions covering the destruction of the heater unit to prevent enemy use.

1-4. PREPARATION FOR STORAGE OR SHIPMENT. For other storage requirements or for shipment instructions, refer to Chapter 3, Section VII. Administrative storage requirements will be in accordance with the following:

a. Placement of equipment in administrative storage should be for short periods of time when a shortage of maintenance effort exists. Items should be in mission readiness within 24 hours or within the time factors as determined by the directing authority. During the storage period appropriate maintenance records will be kept.

1-4. PREPARATION FOR STORAGE OR SHIPMENT - Continued.

b. Before placing equipment in administrative storage, current maintenance services and equipment serviceable criteria (ESC) evaluations should be completed, shortcomings and deficiencies should be corrected, and all modification work orders (MWO's) should be applied.

c. Storage site selection. Inside storage is preferred for items selected for administrative storage. If inside storage is not available, trucks, vans, conex containers and other containers may be used.

1-5. NOMENCLATURE CROSS REFERENCE LIST.

Common Name	Official Nomenclature
Centrifugal Fan	Blower Assembly
Fuel Gage	Liquid Level Gage
Heater Unit	Heater, Duct Type, Portable, HDU-36/E, 120,000 BTU, Model H82
Hour Meter	Time Totalizing Meter
INTERNAL TANK/EXTERNAL Tank Selector	3-Way Ball Valve
OFF/VENT/HEAT Switch	Rotary Switch
ON/OFF Switch	Toggle Switch
Relay (K8)	Safety Switch Control Assembly

1-6. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR). If your heater unit needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to us at: Commander, U.S. Army Troop Support Command, ATTN: AMSTR-QX, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798 (Army). We'll send you a reply.

1-7. LIST OF ABBREVIATIONS.

ac	alternating current
Btu	British thermal unit
C	Degrees Celcius
cfm	cubic feet per minute
cm/m	cubic meters/minute
F	Degrees Fahrenheit
f	feet

Hz	Hertz
in	inch or inches
kg	kilograms
lb	pounds
m	meters
mm	millimeters
psi	pounds per square inch
rpm	revolutions per minute
Vac	Volts ac

Section II. EQUIPMENT DESCRIPTION AND DATA

Para.

Equipment Characteristics, Capabilities, and Feature..........1-8

Location and Description of Major Components...............1-9

Equipment Data..................1-10

1-8. EQUIPMENT CHARACTERISTICS, CAPABILITIES,AND FEATURES.

a. Characteristics.

(1) Portable.

(2) Requires outside power source.

(3) Heats and ventilates shelters used in the Bare Base Equipment System.

(4) Rated at 120,000 Btu per hour.

b. Capabilities and Features.

(1) Can operate as either a heater or a fresh air ventilator.

(2) When operating as a heater, the heater unit can operate as either a recirculating or a fresh air heater.

(3) Draws fuel for heating purposes from either the internal fuel tank or an external fuel source.

(4) When operating as a heater, the heater unit can be operated unattended for up to 24 hours in ambient air temperatures ranging from -65°F (-53°C) to +70°F (+21°C).

(5) When operating as a ventilator, the heater unit can be operated continuously in ambient air temperatures ranging from +70°F (+21°C) to +125°F (+52°C).

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.

a. Left and Front Side. (Refer to Figure 1-2).

(1) Supply Air Duct. The supply air duct (1) moves the hot air from the heater unit to the shelter.

(2) Return Air Duct. The return air duct (2) brings return air back to the heater unit for reheating.

(3) Instruction Plates. The instruction plates (3) provide instructions for the operation of the heater unit.

(4) Fresh Air Damper. The fresh air damper (4), when opened, allows fresh air to be drawn into the heater unit and used in the ventilating or fresh air heating mode.

(5) Control Panel. The control panel (5) contains the operator controls and indicators used during the operation of the heater unit.

(6) Return and Supply Air Dust Covers. The return and supply air dust covers (6) prevents dust and debris from entering the heater unit when the unit is not in operation.

(7) Power Cable. The power cable (7) is to be connected to a power source to operate the heater unit.

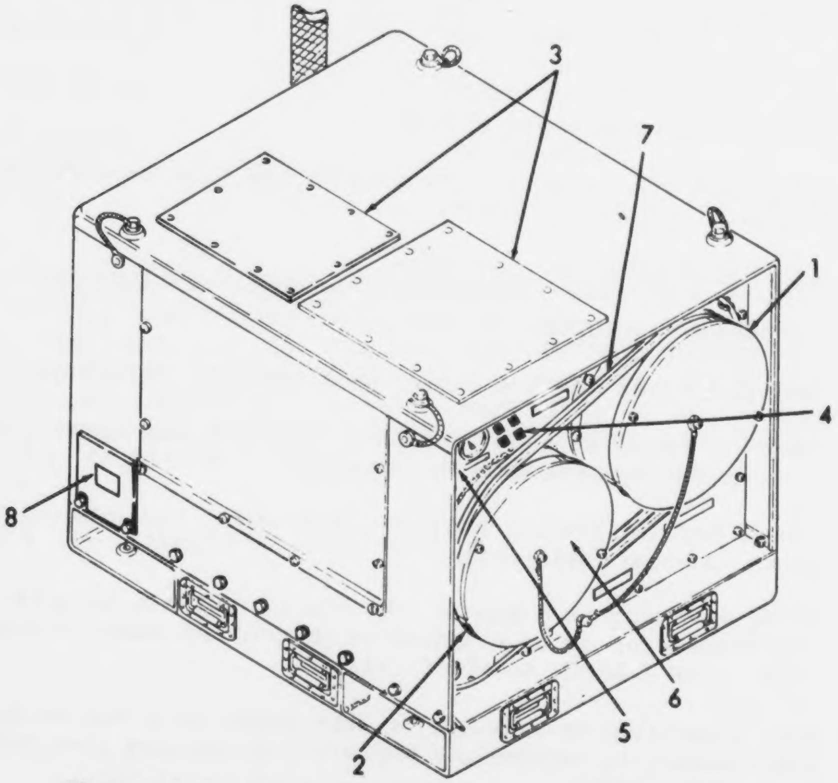


Figure 1-2. Heater Unit, Front and Left Side.

(8) Exhaust Pipe Stowage Compartment. The exhaust pipe is stored in the exhaust pipe stowage compartment (8) when the heater unit is being shipped, stored, or not in use.

b. Rear and Right Side. (Refer to Figure 1-3).

(1) Exhaust Pipe. The exhaust pipe (1) provides for removing the exhaust gases from the heater unit's burner during operation as a heater.

(2) Exterior Fuel Connection. The external fuel connection (2) is protected by a removable cap. The external fuel source is connected here.

(3) Fuel Gage. The fuel gage (3) indicates the amount of fuel remaining in the internal fuel tank. The gage is a direct reading type.

(4) Fuel Tank Cap. The fuel tank cap (4) prevents dirt and debris from entering the internal fuel tank. This cap is removable for filling the internal fuel tank.

(5) Sightglass. The sightglass is used to look into the burner/heat exchanger compartment to insure burner flame is functioning properly.

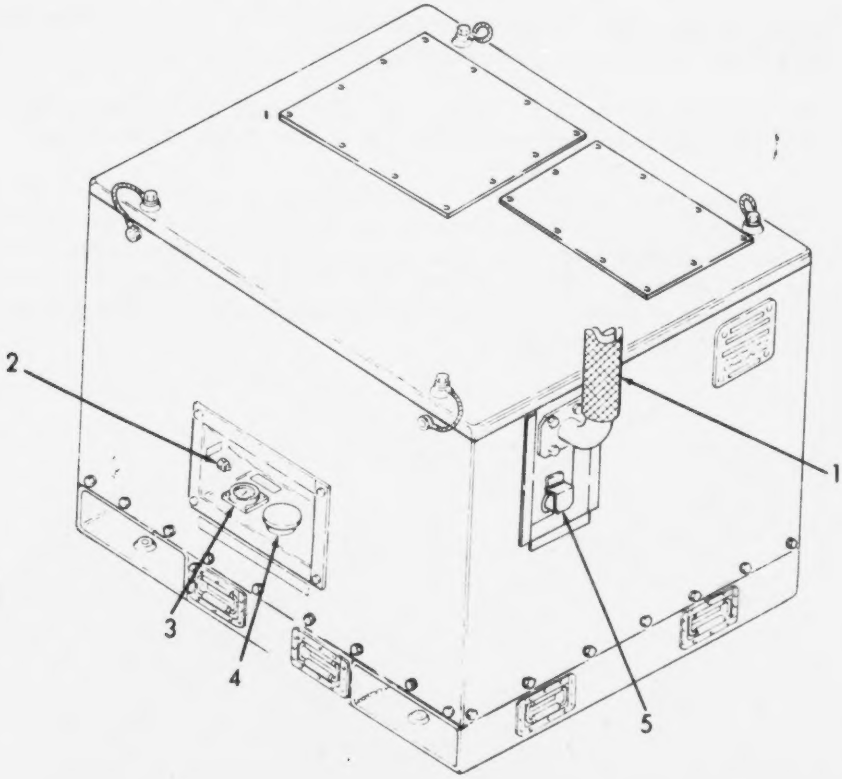


Figure 1-3. Heater Unit, Rear and Right Side.

1-9. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - Continued.

c. Heater Interior. (Refer to Figure 1-4).

(1) Centrifugal Fan. The centrifugal fan (1) is a "squirrel cage" fan and provides the motive force for the air. Both heated air and burner forced air is provided by this fan.

(2) Motor (B1). The motor (2) drives the centrifugal fan (1) and the fuel pump (3).

(3) Fuel Pump. The fuel pump (3) is driven by the motor (2) and pulls fuel from the internal tank or external fuel source, pressurizes it, and feeds it into the burner.

(4) Fuel Filter. The fuel filter (4) filters the fuel to remove all dirt and debris.

(5) Fuel Tank. The fuel tank (5) holds 26 gallons of fuel for use by the heater unit.

(6) Fuel Solenoid Valve. The fuel solenoid valve (6) controls the flow of fuel during heater operation.

(7) Heat Exchanger. The heat exchanger (7) contains the burner and provides the means for heating the air (recirculated or fresh).

(8) Air Filters. The air filters (8) filter out and remove dust, dirt, and debris from the incoming fresh air prior to heating.

(9) Temperature Controller. The temperature controller (9) detects the temperature of the return air and the discharge air to compare these readings with the two temperature control adjustment knobs on its housing. This device will turn on or turn off the burner as determined by the controller's temperature settings and indications from its sensors.

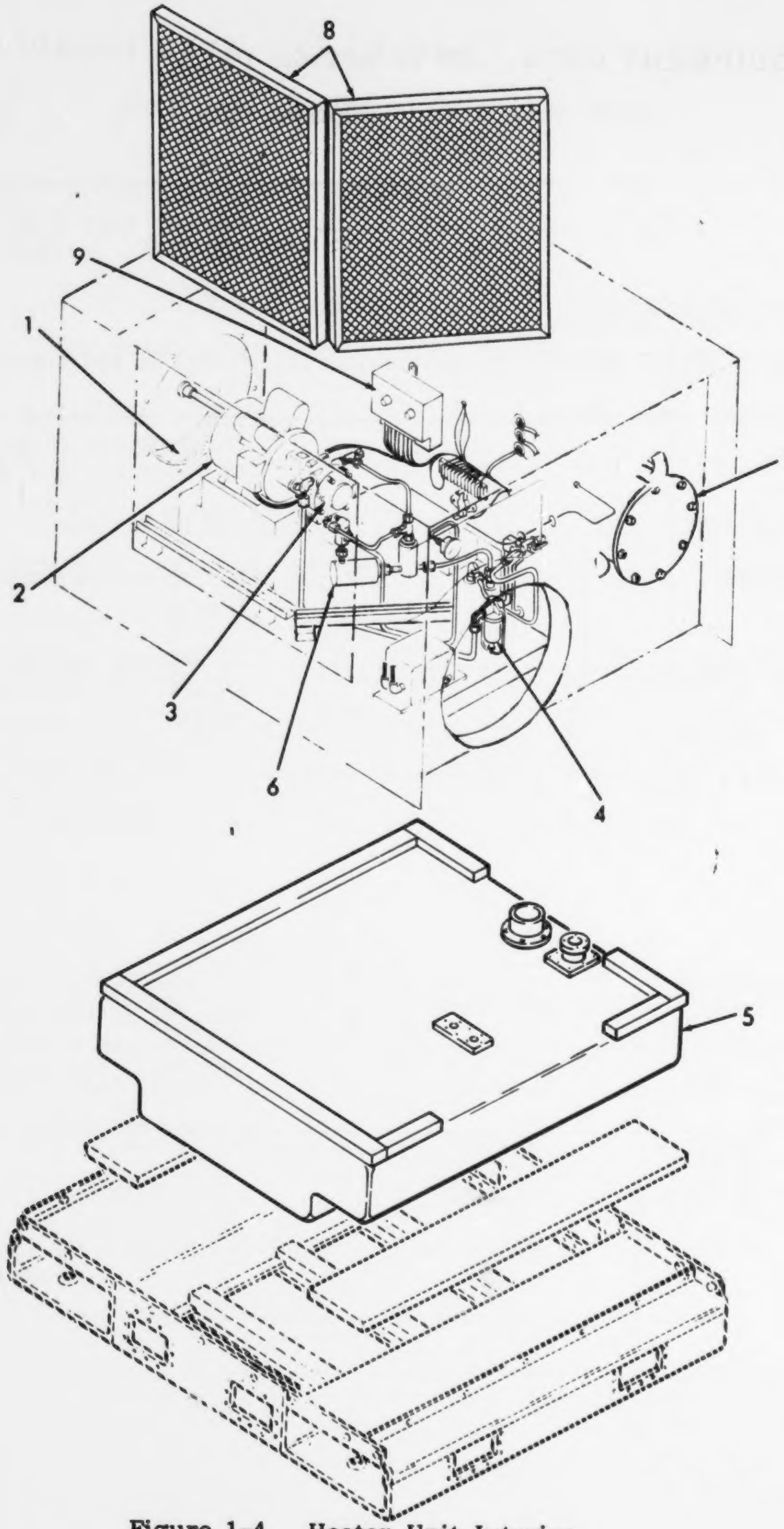


Figure 1-4. Heater Unit Interior.

1-10. EQUIPMENT DATA. (Refer to Table 1-1).

Table 1-1. Equipment Data

Nomenclature	Heater, Duct Type, Portable, HDU-36/E, 120,000 Btu/hour
Manufacturer's Model Number	H82
Manufacturer's Serial Number	H8200001 and subsequent
Electrical Power Requirements	120(+/-10) volts, 50/60 Hz 20/25 ampere circuit breaker or fused circuit power supply
Power Consumption	1.5 kW maximum
Starting Current	60 amperes maximum at -65°F (-53°C)
Operating Current	25 amperes maximum at -65°F (-53°C); 15 amperes at normal ambient
Weight	300 lbs. (150 kg)
Height	32 in. (813 mm)
Length	41.5 in. (1054 mm)
Width	34.5 in. (876 mm)
Heating Capacity	120,000 Btu at 0°F (-17.8°C) ambient at sea level; 100,000 Btu/hour at elevations above 5000 ft. (1829.3 m)
Fuel Capacity	26 gallons (102.2 liters)

1-10. EQUIPMENT DATA - Continued.

Table 1-1. Equipment Data - Continued

Fuel pressure settings for variable altitude and frequency:

Elevation	Fuel Pressure Setting at 60 Hz	Fuel Pressure Setting at 50 Hz
Sea Level to 1000 ft. (304.8 m)	130 - 125*	125 - 120
1000 ft. (304.8 m) - 2000 ft. (609.7 m)	125 - 120	120 - 115
2000 ft. (609.8 m) - 3000 ft. (914.6 m)	120 - 115	115 - 110
3000 ft. (914.6 m) - 4000 ft. (1219.5 m)	115 - 110	110 - 100
4000 ft. (1219.5 m) - 5000 ft. (1524.4 m)	110 - 100	100 - 90
5000 ft. (1525.4 m) - 6000 ft. (1829.3 m)	100 - 90	90 - 80

* Factory Setting

Types of Fuel:

Ambient Temperature	Specification	Military Symbol
Above 20°F (6.7°C)	VV-F-800	DF-2
+20°F (-6.7°C) to -25°F (-32.2°C)	VV-F-800	DF-1
Below -25°F (-32.2°C)	VV-F-800	DF-A
+70°F (21.1°C) to -65°F (-54.4°C) Alternate	MIL-T-5624	JP-4

Section III. TECHNICAL PRINCIPLES OF OPERATION

	Para.		Para.
General	1-11	Fuel System	1-13
Electrical System	1-12	Airflow System	1-14

1-11. GENERAL. This section provides the theory of operation and a functional description of components comprising the heater. Three systems generally comprise the heater: the electrical system, the fuel system, and the airflow system. These systems are described in the paragraphs that follow.

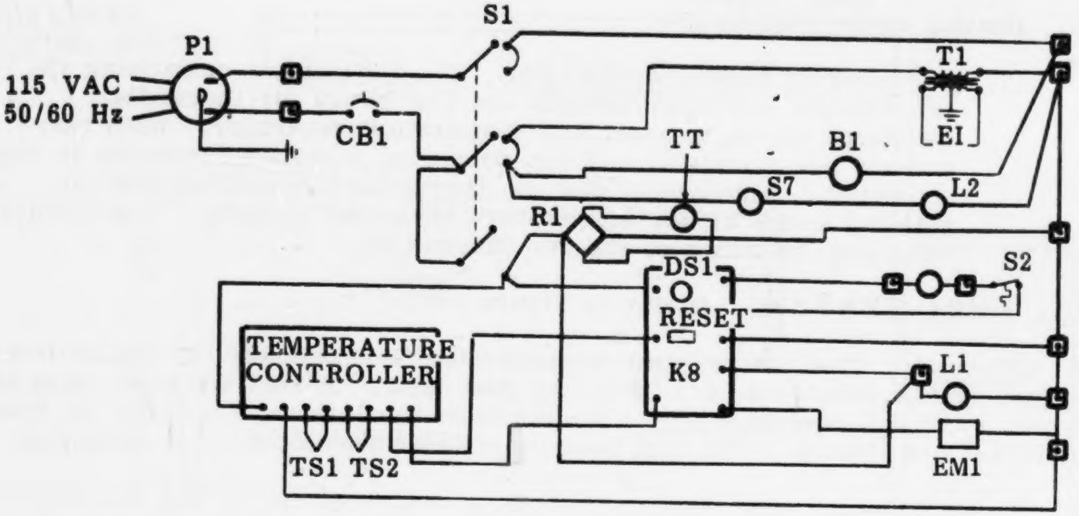
1-12. ELECTRICAL SYSTEM. (Refer to Figure 1-5.)

The electrical system provides for two modes of operation: the heating mode and the ventilating mode. A functional description of these modes is described in the following paragraphs.

a. Ventilation Mode. The ventilation mode is initiated when mode selector switch S1 is set to vent. Initially, 120-vac, 50/60-Hertz, single-phase power is applied through main power plug P1 and circuit breaker CB1 to open contacts of mode selector switch S1, which powers the motor.

b. Heating Mode. The heating mode is initiated when mode selector switch S1 is set to heat and the K8 reset button is set. Initially, 120-vac power is applied through main power plug P1 and circuit breaker CB1 to mode selector switch S1, which powers the motor B1. Continued operation of the heating mode is dependent upon combustion control relay K8 and its associated controls. In addition to the 120-vac power input (black lead) and the neutral (white lead), two input circuits and two output circuits are provided by relay combustion control K8. One input, namely the flame detector circuit, includes the safety devices. The other input, namely the thermostat circuit, includes the temperature control devices and the control relay contacts. Both the flame detector and thermostat circuits must be completed to provide an output for the fuel solenoid. Functional descriptions of these circuits are contained in the paragraphs that follow.

(1) Flame Detector. Components comprising the circuit are temperature limit switch S2 and flame detector D1. After depressing K8 reset button the flame detector circuit will be overridden for approximately 10 to 13 seconds. During this time, if the temperature controller thermostat circuits are closed, power will be applied to fuel solenoid valve L1 through combustion control relay K8. When ignition occurs, flame detector D1 will complete the flame detector circuit. Should the flame detector circuit open due to an overheat condition in the heat exchanger, or a flameout, power will be removed from solenoid valve L1, safety release light DS1 will illuminate, and audible alarm EM1 will sound.


S1
P1
115 VAC
50/60 Hz
CB1
T1
EI
TT
B1
S7
L2
R1
DS1
RESET
S2
TEMPERATURE
CONTROLLER
K8
L1
TS1
TS2
EM1

LEGEND:

B1	Ventilation Fan Motor
CB1	Circuit Breaker
D1	Flame Detector
DS1	Indicator Light
E1	Electrode
EM1	Audible Alarm
K8	Relay-Combustion Control
L1	Solenoid Valve
L2	Purge Valve
P1	Main Power Plug
R1	Rectifier (115 VAC to 28 VDC)
S1	Switch - Mode Selector
S2	Switch - Temperature Limit
S7	Toggle Switch - Purge
T1	Transformer - Ignition
TS1	Temperature Sensor (Return Air)
TS2	Temperature Sensor (Discharge Air)
IT	Total Time Meter

Figure 1-5. Electrical Schematic.

1-12. ELECTRICAL SYSTEM - Continued.

b. Heating Mode - Continued.

(2) Temperature Controller Circuits. The components comprising the temperature controller circuits are the return air thermostat, discharge air thermostat, and temperature controller. Both thermostats are adjustable and are connected in series internally in the controller. Adjustment of these thermostats is accomplished by rotating knobs on the temperature controller housing. The burner will cycle on either of the two thermostats.

1-13. FUEL SYSTEM. (Refer to Figure 1-6.)

a. General. The fuel system is illustrated schematically on figure 1-6. The fuel system incorporates a 26-gallon fuel tank. A fuel transfer valve is provided to enable operation of the heater from the internal fuel tank or from an external fuel source. The fuel pump operates when motor B1 is operating.

b. Purge System. The purge system is provided to enable the operator to purge the unit upon initial startup of the heater, when operating from an external fuel source, or when attempting to start the unit after the external fuel system has been allowed to run dry. Priming the fuel system at extremely low ambient temperature with the correct fuels presents no problems except that it takes slightly longer due to the greater restriction of fuel movement by cold fuel circulating through the filter. Priming the fuel system is done by turning the mode selector switch to the VENT position, holding switch S7 to the on position until the fuel pressure gauge reads greater than zero. When switch S7 is released; the pressure must be greater than 10 psi. If not, purging must be continued to bleed the fuel system until the pressure is greater than 10 psi with switch S7 off.

c. Heating Mode. In the heating mode, fuel is drawn through the fuel filter by the fuel pump. Upon thermostat demand, fuel is supplied to the nozzle at the required set pressure as indicated on the fuel pressure gauge. Unused fuel is bypassed back to the pump through the secondary bypass line. Upon attaining the desired discharge or return air temperature, solenoid valve L1 will assume the normally open position and all fuel will return to the pump through the primary bypass line and will be recirculated through the fuel pump.

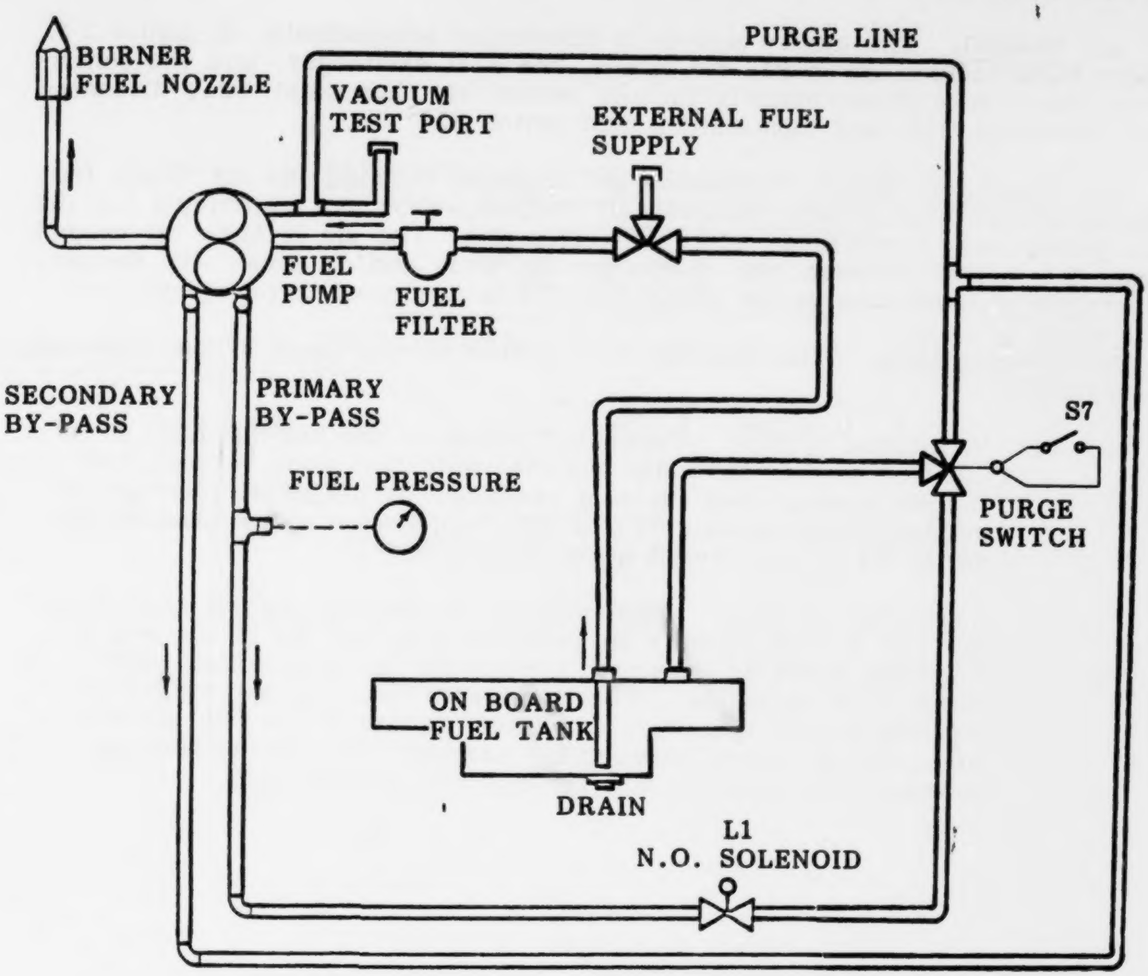

BURNER
FUEL NOZZLE
PURGE LINE
VACUUM
TEST PORT
EXTERNAL FUEL
SUPPLY
FUEL
PUMP
FUEL
FILTER
SECONDARY
BY-PASS
PRIMARY
BY-PASS
S7
FUEL PRESSURE
PURGE
SWITCH
ON BOARD
FUEL TANK
DRAIN
L1
N.O. SOLENOID

Figure 1-6. Fuel System Schematic.

1-14. AIRFLOW SYSTEM. (Refer to Figure 1-7.)

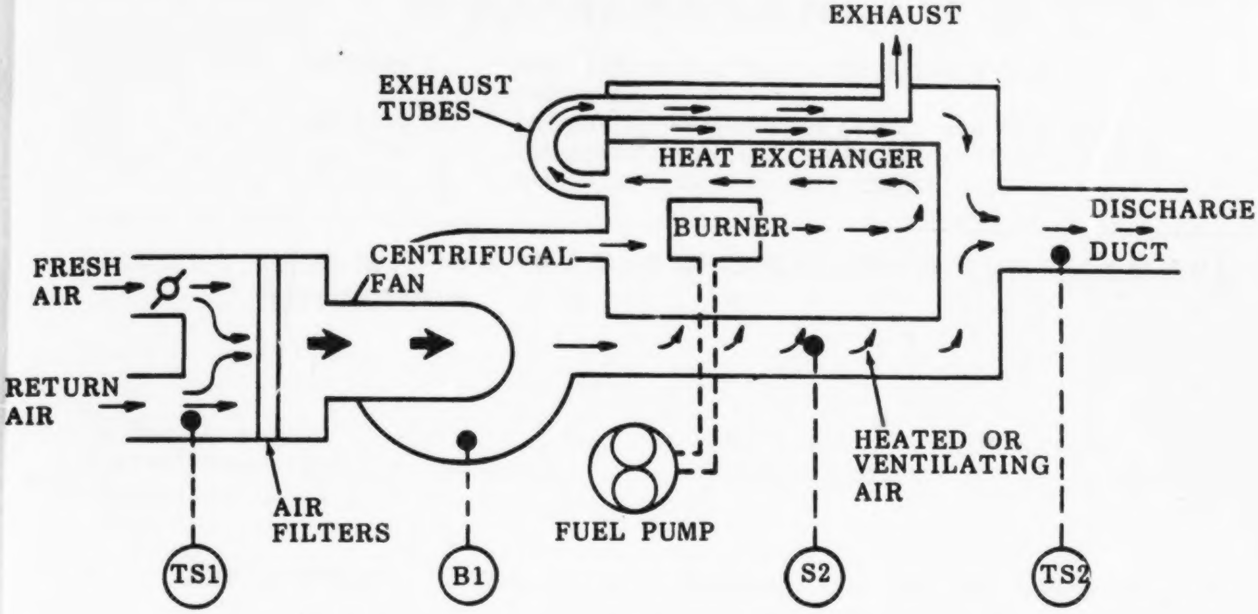
a. General. The airflow system is illustrated schematically on figure 1-7. Major items include motor B1, air filters, the heat exchanger, and the centrifugal fan. Related components include return air thermostat TS1, discharge air thermostat TS2, and temperature limit switch S2.

b. Ventilation Mode. Ventilation air is drawn through the air filters from the return air duct and/or the fresh air damper. From the centrifugal fan the air passes over surfaces of the heat exchanger. The air is then discharged from the heater through the discharge air duct and/or fresh air damper. Operation of the discharge air thermostat TS2 is described in paragraph 1-13.

c. Heating Mode. The heating mode airflow is described in the following paragraphs.

(1) Ventilation Airflow. Ventilation airflow in the heating mode is identical to that described for the ventilation mode, except that the air passing over the heat exchanger is heated as required by demand of thermostats TS1 or TS2. Operation of temperature limit switch S2 is also described in paragraph 1-12.

(2) Combustion Airflow. Combustion air is supplied by the centrifugal fan. It is high velocity air provided from the top of the centrifugal fan scroll or housing. Combustion air is provided when motor B1 is operating. This air passes from the centrifugal fan into the burner assembly, and after ignition of the fuel-air mixture, the air passes through the exhaust tubes to the flue gas collector and exits the unit through the exhaust pipe.


EXHAUST
EXHAUST TUBES
HEAT EXCHANGER
BURNER
DISCHARGE DUCT
CENTRIFUGAL FAN
FRESH AIR
RETURN AIR
AIR FILTERS
FUEL PUMP
HEATED OR VENTILATING AIR
TS1
B1
S2
TS2

LEGEND:

B1	Motor
S2	Temperature Limit Switch
TS1	Return Air Temperature Sensor
TS2	Discharge Air Temperature Sensor

Figure 1-7. Airflow Schematic.

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. Description and Use of Operator's Controls and Indicators
Section II. Preventive Maintenance Checks and Services
Section III. Operation Under Usual Conditions
Section IV. Operation Under Unusual Conditions

Section I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS

Para.
Introduction....................2-1
Control Panel Controls and Indicators........................2-2
Rear and Right Side Controls and Indicators...............2-3

2-1. INTRODUCTION. This section describes the controls and indicators you, as the operator, will be using most often. Most of your controls and indicators are on the control panel located on the front of the heater unit. The following paragraphs will give you a brief description of each control and indicator.

2-2. CONTROL PANEL CONTROLS AND INDICATORS. (Refer to Figure 2-1 and Table 2-1).

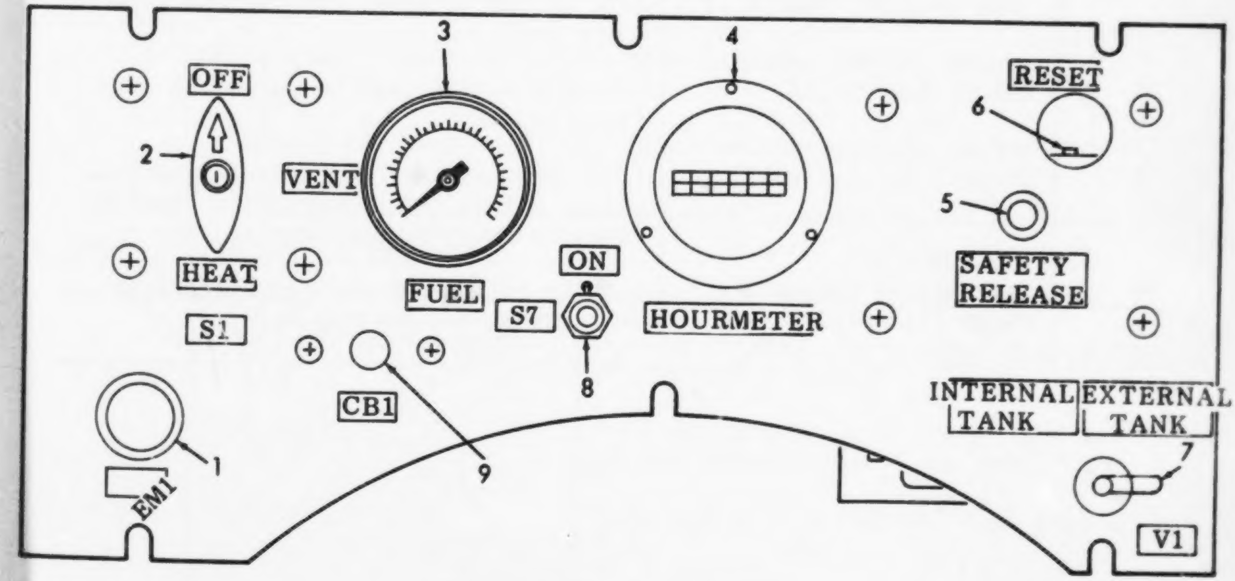

3
4
OFF
RESET
6
2
VENT
5
HEAT
SAFETY RELEASE
ON
FUEL
S7
HOURMETER
S1
CB1
8
INTERNAL TANK
EXTERNAL TANK
7
1
9
EM1
V1

Figure 2-1. Control Panel.

Table 2-1. Control Panel, Controls and Indicators

KEY	CONTROL OR INDICATOR	FUNCTION
1	Audible Alarm (EM1)	Sounds whenever the heater is shut down because of an overtemperature condition or burner flameout.
2	OFF/VENT/HEAT Switch (S1)	Used to place the heater unit into ventilation or heat mode and to shutdown the heater unit.
3	FUEL Pressure Gage	Provides a constant indication of the fuel system pressure (in psi) of the fuel pump output.
4	HOUR METER	Provides a continuous indication of the total operating time of the heater unit in hours and tenths of hours.
5	SAFETY RELEASE Indicator	Illuminates any time the safety relay (K8) is tripped.
6	RESET Switch	This switch must be pressed to reset the heater unit relay (K8) when the relay has been tripped.
7	INTERNAL TANK/EXTERNAL TANK Selector Switch (V1)	Used to select either the internal fuel tank or the external fuel source (if connected).
8	ON/OFF Switch (S7)	A toggle switch used to purge the fuel lines of air.
9	Circuit Breaker (CB1)	Trips whenever an overcurrent condition exists within the heater unit. Must be manually reset by pushing in.
10	Temperature Controller Knobs (See Figure 2-12)	Used to set output air temperature of unit during the heating mode.

2-3. REAR AND RIGHT SIDE CONTROLS AND INDICATORS. (Refer to Figure 2-2 and Table 2-2).

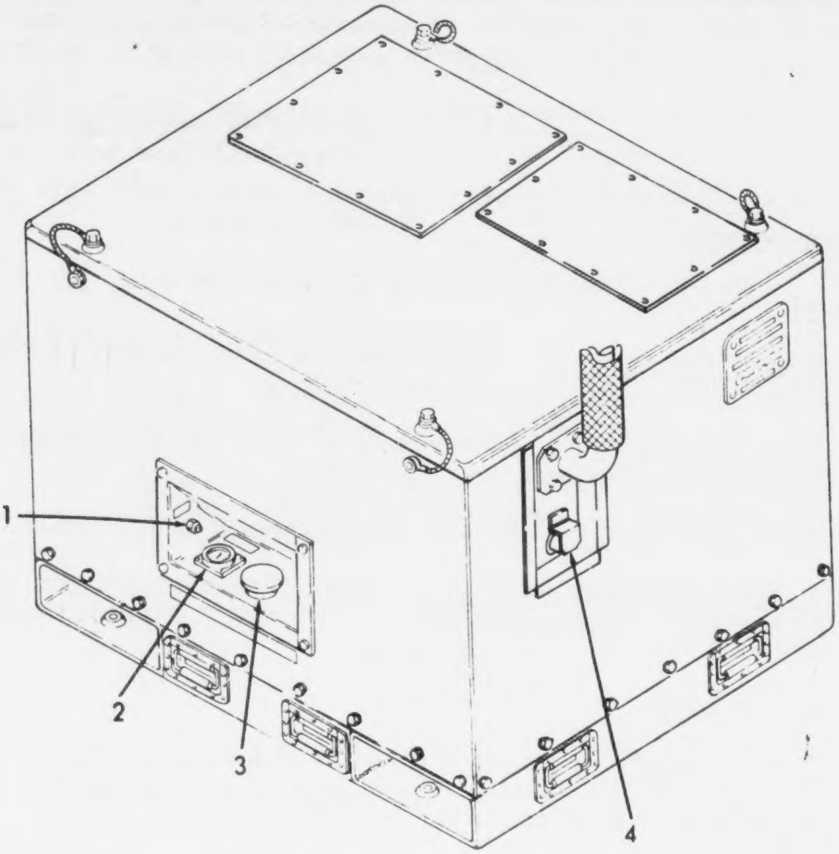


Figure 2-2. Rear and Right Side Controls and Indicators.

Table 2-2. Rear and Right Side Controls and Indicators

KEY	CONTROL OR INDICATOR	FUNCTION
1	External Fuel Connection	Used to connect the external fuel source to the heater unit.
2	Fuel Gage	Used to provide a continuous indication of the internal tank fuel level.
3	Fuel Filler Cap	Used to fill the internal fuel tank with fuel.
4	Sightglass	Used to visually verify burner operation.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

Para.

Introduction....................2-4

Operator Preventive Maintenance Checks and Services.....2-5

2-4. INTRODUCTION.

a. General.

(1) Before You Operate. Always keep in mind the CAUTIONS and WARNINGS. Perform your (B) PMCS.

(2) While You Operate. Always keep in mind the CAUTIONS and WARNINGS. Perform your (D) PMCS.

(3) After You Operate. Be sure to perform your (A) PMCS.

(4) If Your Equipment Fails to Operate. Troubleshoot with proper equipment. Report any deficiencies using the proper forms. See DA PAM 738-750.

b. PMCS Procedures.

(1) Purpose of PMCS. Your Preventive Maintenance Checks and Services list the inspections and care of your equipment required to keep it in good operating condition.

(2) Item Number Column. Checks and services are numbered in chronological order regardless of interval. This column is used as a source of item numbers for the "Item Number" column on DA Form 2404, Equipment Inspection and Maintenance Worksheet, in recording results of PMCS.

(3) Interval Column. The interval columns tell you when to do a certain check or service: before, during, or after operation. Sometimes a dot may be placed in more than one interval column which would mean you should do the check or service at each of those intervals.

(4) Item to Be Inspected Column. This column lists the common name of the item to be inspected such as "Air Filters".

(5) Procedures Column. This column tells you how to do the required checks and services. Carefully follow these instructions.

(6) Equipment is Not Ready/Available if Column. This column tells you when and why your equipment cannot be used.

NOTE

The terms "Ready/Available" and "Mission Capable" refer to the same status: equipment is on hand and is able to perform its combat missions. (See DA PAM 738-750).

(7) Increased Inspections. Perform weekly as well as Before Operations PMCS if:

(1) You are the assigned operator and have not operated the item since the last weekly.

(2) You are operating the item for the first time.

(8) Leakage is classified as follows.

(1) Class I: Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

(2) Class II: Leakage of fluid great enough to form drops but not great enough to cause drops to drip from the item being checked/inspected:

(3) Class III: Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

CAUTION

- Equipment operation is allowable with minor leakage (Class I or II). Of course, you must consider the fluid capacity in the item being checked/inspected. When in doubt, notify your supervisor.
- When operating with Class I or Class II leaks, continue to check fluid levels as required in your PMCS.
- Class III leaks should be reported to your supervisor or organizational maintenance.

2-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES.

NOTE

If the equipment must be kept in operation, check and service only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

2-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Continued.

Table 2-3. Operator Preventive Maintenance Checks and Services

B - Before D - During A - After W - Weekly M - Monthly

Item No.	Interval					Item to be Inspected Procedure	Equipment is not Ready/Available if:
	B	D	A	W	M		
1	●	●	●			Inspect access door for loose mounting, missing fasteners, dents, or corrosion.	Door is missing or inoperable.
2	●		●		●	Inspect lifting handles for loose mounting, missing fasteners, missing parts, bends, or corrosion.	
3					●	Inspect instruction plates for loose mounting, missing fasteners, dents, and corrosion.	
4	●	●	●			Inspect control panel for broken or missing knobs and broken gages.	Broken or missing gages or switches.
				●		Inspect entire control panel for loose mounting, missing hardware, corrosion, or broken or missing controls/indicators.	
5	●	●	●		●	Inspect power cable for frayed insulation, cracks, damaged connector, corrosion or deterioration of connector terminals.	Exposed conductor.
6	●		●	●		Inspect return and supply air ducts dust cover for cracks, holes, worn areas, broken chain, loose fit or insecure mounting.	
7	●	●	●			Inspect return and supply air duct and clamps for holes, tears, and damaged duct clamps.	Damaged duct tube.
8	●	●	●			Inspect external fuel connection for missing cap, damaged threads and corrosion.	External fuel source cannot be connected.
9	●	●	●			Inspect fuel gage for broken glass, bent pointer, and corrosion.	

Item No.	Interval					Item to be Inspected Procedure	Equipment is not Ready/Available if:
	B	D	A	W	M		
10	●		●			Inspect fuel tank cap for defective or damaged cap, dents, cracks, or corrosion. Be sure that cap is present and fits securely.	Missing fuel filler cap.
11	●		●		●	Inspect exhaust pipe stowage door for loose mounting, missing fasteners, dents or corrosion.	
12	●	●	●	●		Inspect cabinet exterior for dents, holes, exposed metal, or corrosion.	
13	●	●	●	●		Inspect exhaust pipe for dents, holes, corrosion, improper fit.	
14					●	Inspect blower and venturi ring for holes, dents, corrosion, missing blower blades, and loose or missing hardware.	Holes in venturi ring or missing blower blades.
15					●	Inspect fuel transfer valve for leaks, corrosion, or other damage.	Class III leaks.
16					●	Inspect motor base for loose or missing hardware, or corrosion. Inspect motor for freedom of rotation, loose mounting, missing fasteners, correct alinement and corrosion.	Tight shaft or loose mounting.
17					●	Inspect heat exchanger for loose or missing hardware, corrosion, holes, or signs of burner burn through.	Holes in heat exchanger.
18					●	Inspect fuel pump for loose mounting, missing hardware, leaks, or corrosion.	Class III leaks.
19					●	Inspect solenoid valve for loose wiring and/or connections, leaks, corrosion, loose mounting, or missing hardware.	Class III leaks.

2-5. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES - Continued.

Table 2-3. Operator Preventive Maintenance Checks and Services

B - Before D - During A - After W - Weekly M - Monthly

Item No.	Interval					Item to be Inspected Procedure	Equipment is not Ready/Available if:
	B	D	A	W	M		
20					●	Inspect air filters for clogs, holes, or extreme dirtiness. Clean dirty filters by removing ing them and then cleaning using a water spray. Allow to dry completely.	Holes in air filter.
21					●	Inspect ignition transformer for loose mounting, missing fasteners, loose or dirty connections, and corroded or cracked case.	
22					●	Inspect fuel filter for dirt and debris in fuel filter bowl. Drain bowl to eliminate any water which may have settled in bowl.	

Section III. OPERATION UNDER USUAL CONDITIONS

Para.

Assembly and Preparation for Use............................2-6

Operating Procedures............2-7

Para.

Operating Instructions on Decals and Instruction Plates......................2-8

2-6. ASSEMBLY AND PREPARATION FOR USE. These procedures consist of the following:

a. General Precautions.

(1) Do not operate the heater unit in fuel vapor areas or in areas lacking adequate ventilation to support heater fuel combustion.

(2) Do not smoke or use open flame in the vicinity when filling fuel tank.

(3) Always provide metal-to-metal contact between fuel container and fuel tank to prevent a spark from being generated as fuel flows over metallic surfaces.

(4) Do not operate the heater unit inside a building unless the exhaust gases are properly vented to the outside.

(5) Be sure the duct dust covers are removed prior to operation.

(6) A 50-lb. (22.7 kg) capacity carbon dioxide fire extinguisher should be available on a standby basis in the area where the heater unit is to be operated.

(7) Do not operate the heater unit for longer than 10 minutes in the heating mode when the ambient temperature is above +70°F (+21.1°C).

(8) Do not restrict ventilating airflow. Equipment damage and/or improper operation will occur.

b. Siting.

CAUTION

Do not set up the heater unit on extremely unlevel (greater than 8 1/2 degrees from true horizontal position) terrain. Doing so may result in improper operation or damage to equipment.

Position the heater unit approximately 7 ft. (2134 mm) from the shelter. Be sure the heater unit's duct openings face the shelter connections.

2-6. ASSEMBLY AND PREPARATION FOR USE - Continued.

c. Exhaust Pipe Installation. (Refer to Figure 2-3).

(1) Remove exhaust pipe storage compartment door (1) and remove all sections of exhaust pipe from inside compartment.

(2) Loosen four captive screws (7) and remove protective cover (8) from exhaust port on cabinet. Place protective cover inside exhaust pipe storage compartment and install exhaust pipe compartment door (1).

(3) Place tube assembly (5) into position over exhaust port on cabinet and attach by installing four captive screws (6).

(4) Install tube and guard assembly (4) onto tube assembly (5) by slipping enlarged end of tube and guard assembly onto tube assembly.

(5) Install two exhaust pipes (2) and (3) by slipping enlarged ends of pipes over tube and guard assembly (4).

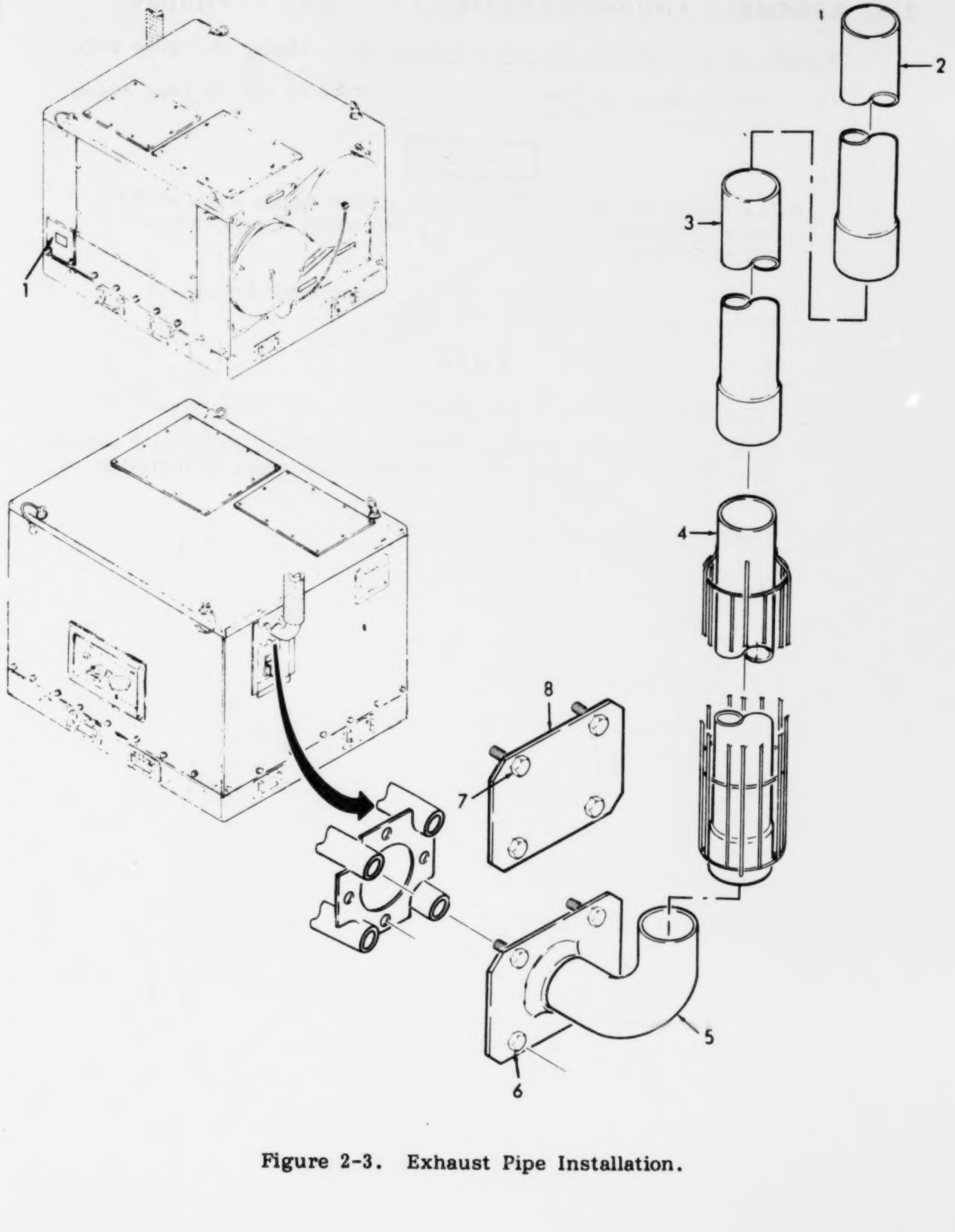


Figure 2-3. Exhaust Pipe Installation.

2-6. ASSEMBLY AND PREPARATION FOR USE - Continued.

d. Supply Air and Return Air Ducts Connection. (Refer to Figure 2-4).

(1) Remove supply and return air duct covers (1 and 5) from heater duct connections (6 and 7).

CAUTION

- The supply air duct will have two smooth bends when connected properly. Be careful to avoid sharp bends, which will restrict airflow.
- Do not restrict ventilating airflow. Equipment damage and/or improper operation will occur.

NOTE

Supply air duct is the longer of the two ducts.

(2) Connect air supply and return air ducts (2 and 3) to duct connections (6 and 7). Be sure the airflow direction is as indicated on duct.

(3) Tighten duct clamps (4) securely.

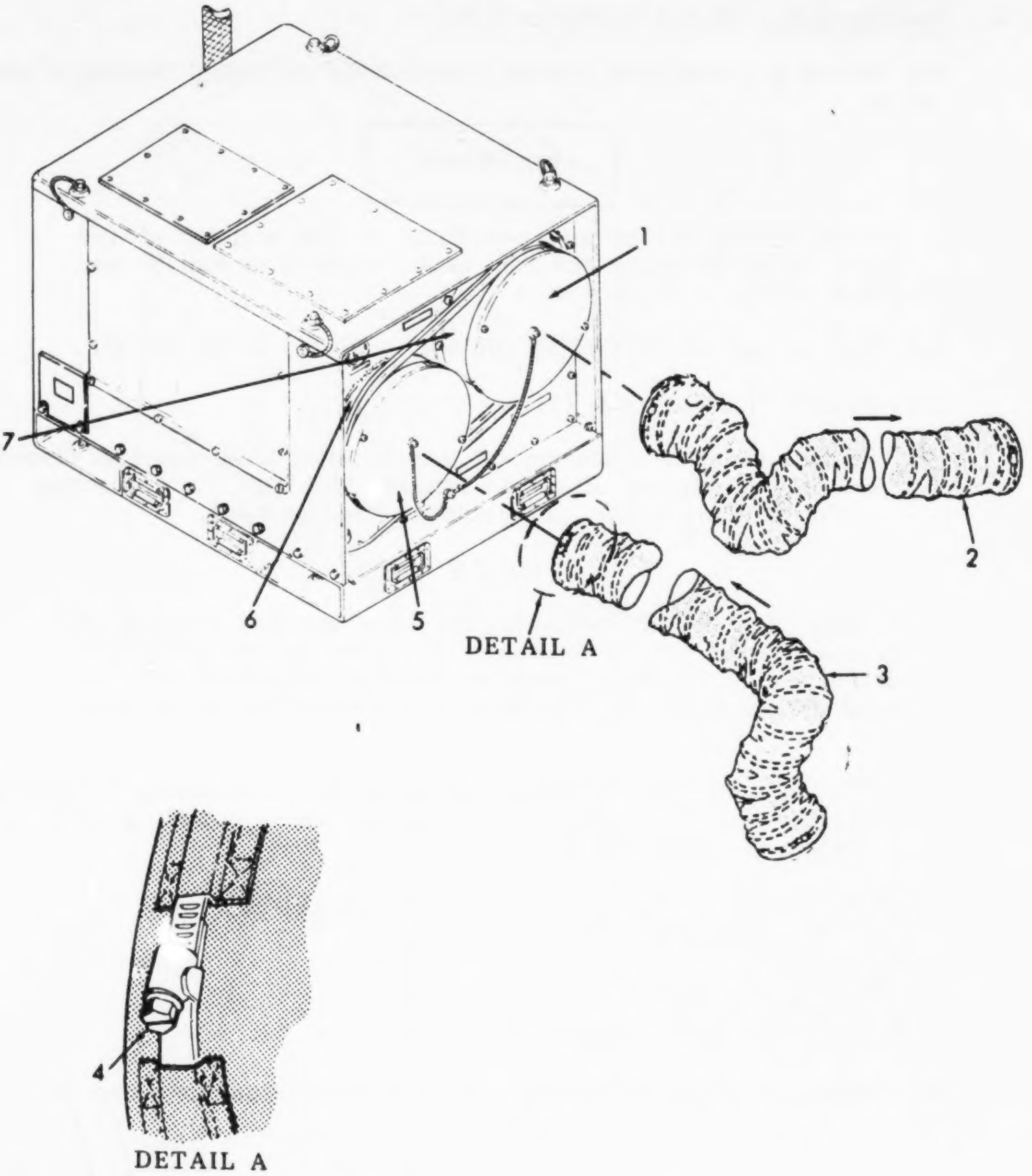

1
7
2
6
5
DETAIL A
3
4
DETAIL A

Figure 2-4. Air Duct Installation.

2-6. ASSEMBLY AND PREPARATION FOR USE - Continued.

e. Fueling Unit. (Refer to Figure 2-5).

The following procedures contain instructions for initial fueling of the heater.

WARNING

Do not smoke or use an open flame in the vicinity of the heater while servicing the fuel tank. Failure to comply may result in injury to personnel.

(1) Ensure that MODE SELECTOR switch S1 (2) is set to OFF.

(2) Remove fuel tank cap (1).

(3) Provide metal-to-metal contact between fuel tank and fuel dispenser to avoid possibility of sparks igniting the fuel. A grounding cable, bonding strap, or equivalent may be used.

NOTE

If diesel fuel is not available, JP-4 turbine fuel conforming to specification MIL-T-5624 may be used as an acceptable alternative. However, greater heating efficiency will be obtained using one of the diesel fuels recommended in step (4).

(4) Fill fuel tank with 26 gallons of diesel fuel conforming to Federal Specification VV-F-800 of the following class depending upon ambient temperature.

Temperature	Military Symbol
Above 20°F	DF-2
Plus 20°F to minus 25°F	DF-1
Below minus 25°F	DF-A
Plus 70° to -65°F (Alternate)	JP-4

(5) Wipe any excess or spilled fuel from heater fuel tank cap (1).

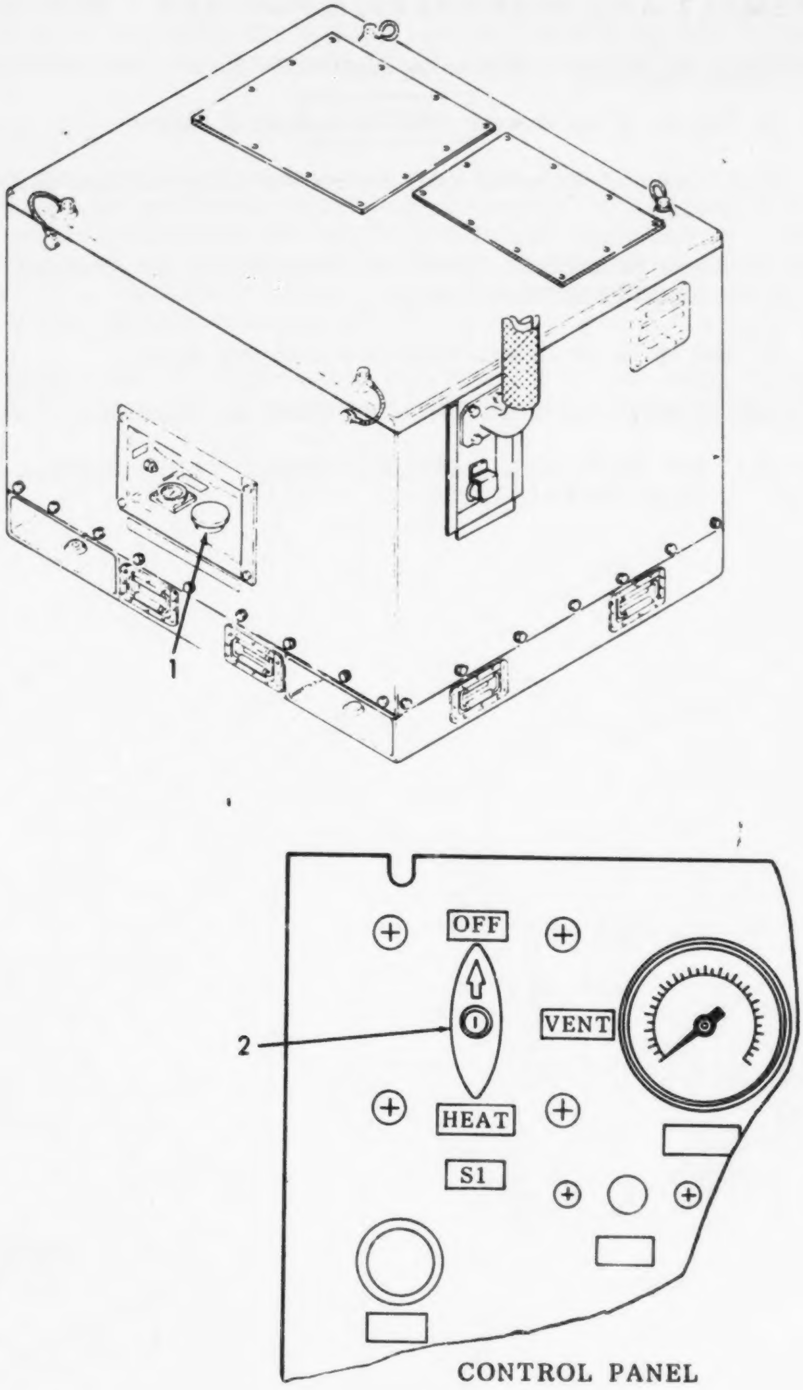

1
OFF
VENT
2
HEAT
S1
CONTROL PANEL

Figure 2-5. Fueling Unit.

2-6. ASSEMBLY AND PREPARATION FOR USE - Continued.

f. Fuel Tank Selection. (Refer to Figure 2-6).

(1) If fuel is to be drawn from an external source:

(a) Connect external fuel source to external fuel tank connection (3).

(b) Set INTERNAL TANK/EXTERNAL TANK selection switch (1) to EXTERNAL TANK.

(2) If fuel is to be drawn from the internal tank:

(a) Check fuel gage (2) and refuel as required.

(b) Set INTERNAL TANK/EXTERNAL TANK selection switch (1) to INTERNAL TANK.

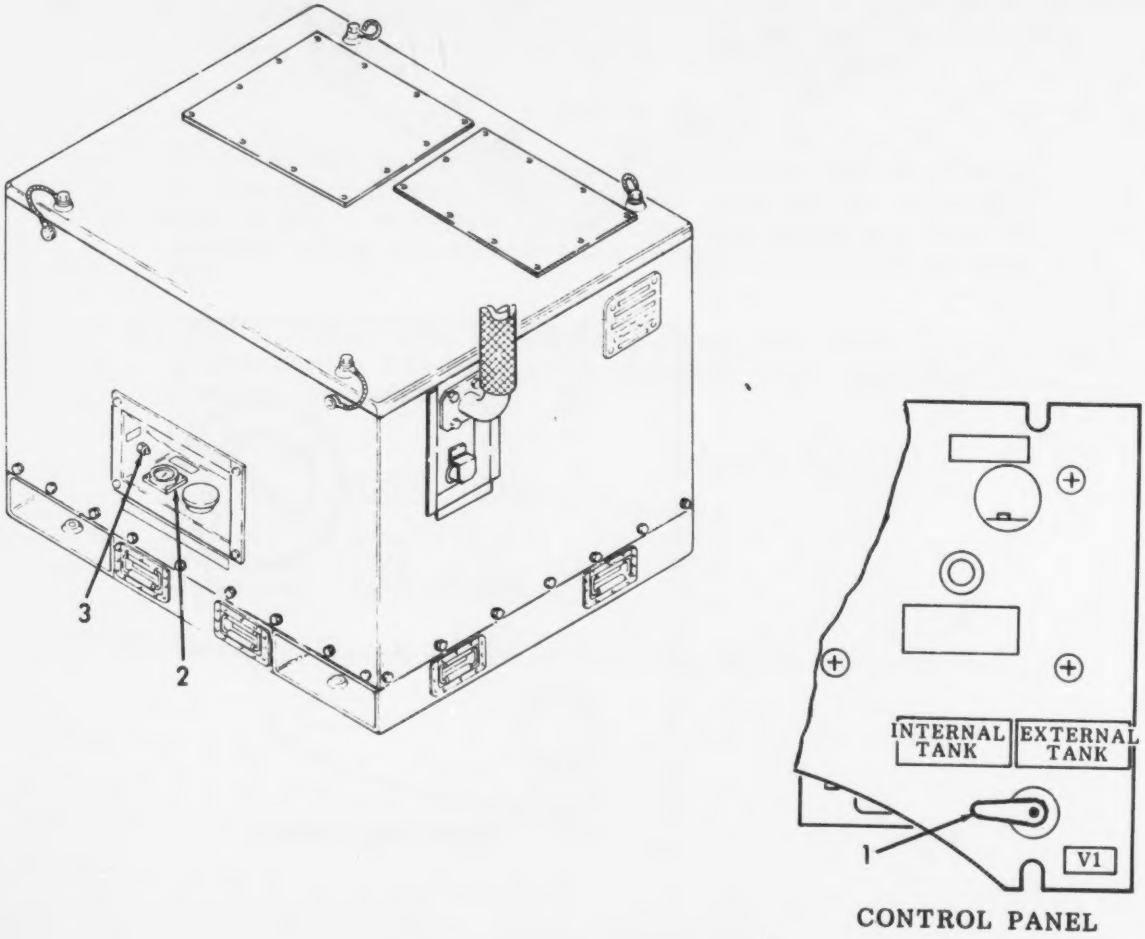


Figure 2-6. Tank Selection.

g. Power Connection. (Refer to Figure 2-7).

(1) Be sure the OFF/VENT/HEAT selector switch S1 (3) is set to OFF position and toggle switch S7 (2) is not in the ON position.

CAUTION

When the heater unit is used in a Bare Base application, refer to the applicable Bare Base Electrical System technical manual or coordinate electrical installation requirements with electrical power management authority before proceeding to step (2). Failure to comply may result in damage to the secondary distribution center (SDC).

(2) Connect heater power cable (1) to a 120(+/-10) volt, 50/60 Hz, single-phase, 20/25 ampere circuit breaker or fused power source.

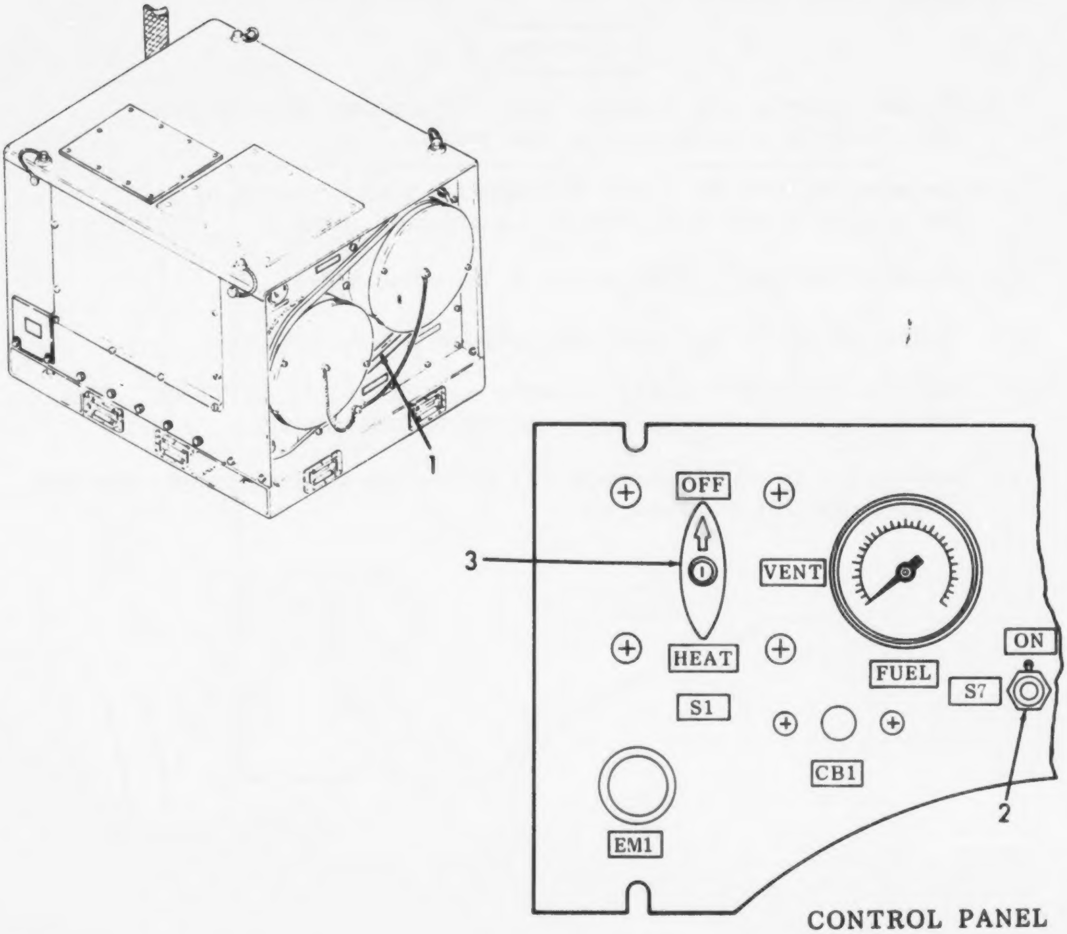


Figure 2-7. Electrical Connection.

2-6. ASSEMBLY AND PREPARATION FOR USE - Continued.

h. Recirculating Air Setup. To set up the unit as a recirculating air unit, perform steps a. through g. above.

i. 100% Fresh Air Set-Up. To operate as a fresh air unit using 100% fresh air, proceed as follows:

(1) Perform steps a. through g. above but do not connect the return air duct. Be sure to remove the return air duct cover.

(2) Open the fresh air damper above the control panel by lifting pendant and chain upward and allow chain to feed into cabinet.

2-7. OPERATING PROCEDURES.

These procedures consist of the following:

a. Ventilation Mode Operation. (Refer to Figure 2-8).

CAUTION

- Do not operate unit without fuel. Operation without fuel will result in damage to the fuel pump.
- Be sure INTERNAL TANK/EXTERNAL TANK switch is in the proper position to supply fuel to fuel pump.

(1) Perform the setup procedures in paragraph 2-6.

(2) Press the circuit breaker CB1 (2) button.

(3) Set the OFF/VENT/HEAT selector switch S1 (1) to VENT. The centrifugal fan should begin operating immediately.

(4) Adjust the fresh air damper (3) above the control panel, for the desired amount of fresh air.

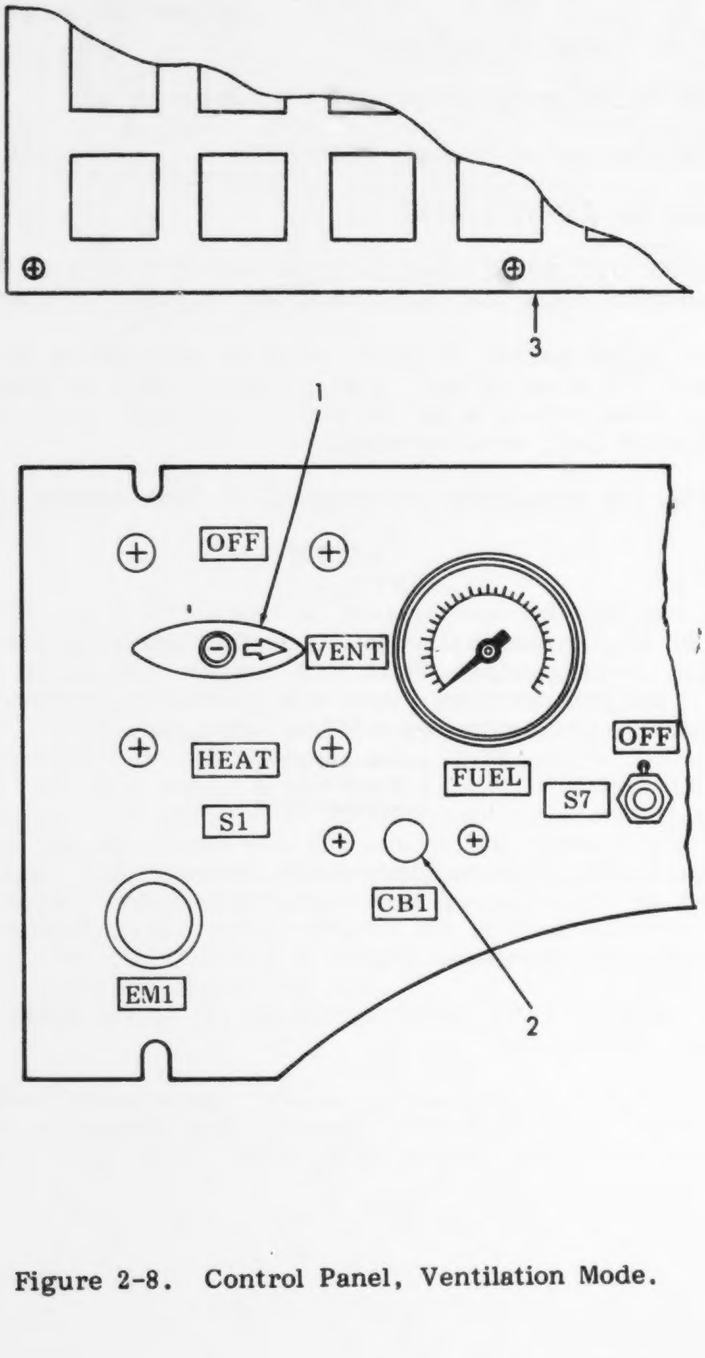

3
1
OFF
VENT
HEAT
FUEL
OFF
S7
S1
CB1
EM1
2

Figure 2-8. Control Panel, Ventilation Mode.

2-7. OPERATING PROCEDURES - Continued.

b. Heating Mode Operation. (Refer to Figure 2-9).

CAUTION

Do not attempt to operate the heater unit in the heating mode for more than 10 minutes when the ambient temperature is above +70°F (+21.1°C). Failure to comply may result in damage to equipment.

(1) Perform the setup procedures in paragraph 2-6.

(2) Press the circuit breaker (CB1) (4).

(3) Press the RESET button (1).

(4) Set the OFF/VENT/HEAT selector switch S1 (5) to VENT for 60 seconds to allow the centrifugal fan to build up speed.

(5) Push toggle switch S7 (3) upward to ON position for 10 seconds to purge fuel lines of air. Fuel pressure gage (6) indication will drop while switch is in ON position and will return to approximately 10 psig when released.

(6) Check the FUEL pressure gage (6). Gage should indicate 10 psig.

NOTE

If the ambient air temperature is below 0°F (-17.8°C) then wait 30 to 45 seconds prior to performing step (7). For optimum heating, open fresh air damper about 25% of full open. At temperatures below 0°F (-17.8°C), reduce fresh air damper opening to about 10% of full open.

CAUTION

After the burner lights up, lift the cover on the rear of the unit and observe the flame through the sightglass located on the rear of the heater unit below the exhaust pipe. If the flame is not bright, notify unit maintenance to adjust the fuel pressure.

(7) Set the OFF/VENT/HEAT switch S1 (5) to the HEAT position to ignite the burner.

(8) Check the fuel pressure gage (6). Gage should indicate fuel pressure required for the elevation and frequency (50 or 60 Hz) at which the heater unit is being used. (See Table 2-4).

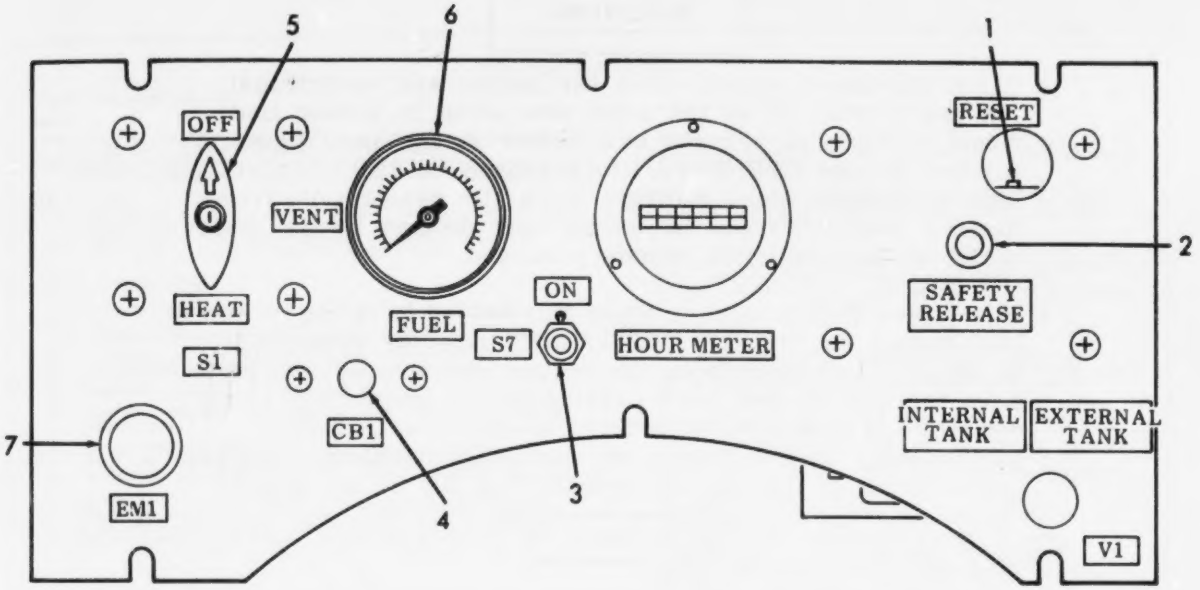

5
6
1
OFF
RESET
VENT
2
SAFETY RELEASE
HEAT
ON
FUEL
S1
S7
HOUR METER
CB1
INTERNAL TANK
EXTERNAL TANK
7
EM1
4
3
V1

Figure 2-9. Control Panel, Heating Mode.

NOTE

If the burner does not ignite within 15 seconds after switch S1 has been placed into the HEAT position or if burner goes out during heating mode, the SAFETY RELEASE light (2) will come on and the audible alarm EM1 (7) will sound. To restart unit switch S1 back into VENT position, depress RESET (1), and repeat steps 5, 6, and 7. If unit fails to operate properly, proceed to troubleshooting procedures.

(9) When operating in recirculating mode, adjust fresh air damper opening for the desired amount of fresh air.

(10) Adjust the temperature by setting the control knobs on the temperature controller inside the unit.

c. Shutdown. (Refer to Figure 2-9).

WARNING

- A hot shutdown occurs when the heater and centrifugal fan are turned off at the same time when in heater mode. Avoid turning off the fan and heater at the same time. Always set the OFF/VENT/HEAT switch to VENT for at least 3 minutes when shutting down the heater unit from heating mode. Failure to comply may damage heater and under some conditions, a safety hazard.
- If a power failure occurs when the heater is firing, immediately set the OFF/VENT/HEAT selector switch (S1) to OFF. Disconnect both the return and supply air ducts from the shelter and turn parallel to the heater unit duct outlets. If available, insert the nozzle of a CO2 fire extinguisher in the supply air duct and discharge CO2 in short blasts of one or two seconds for six to ten blasts.

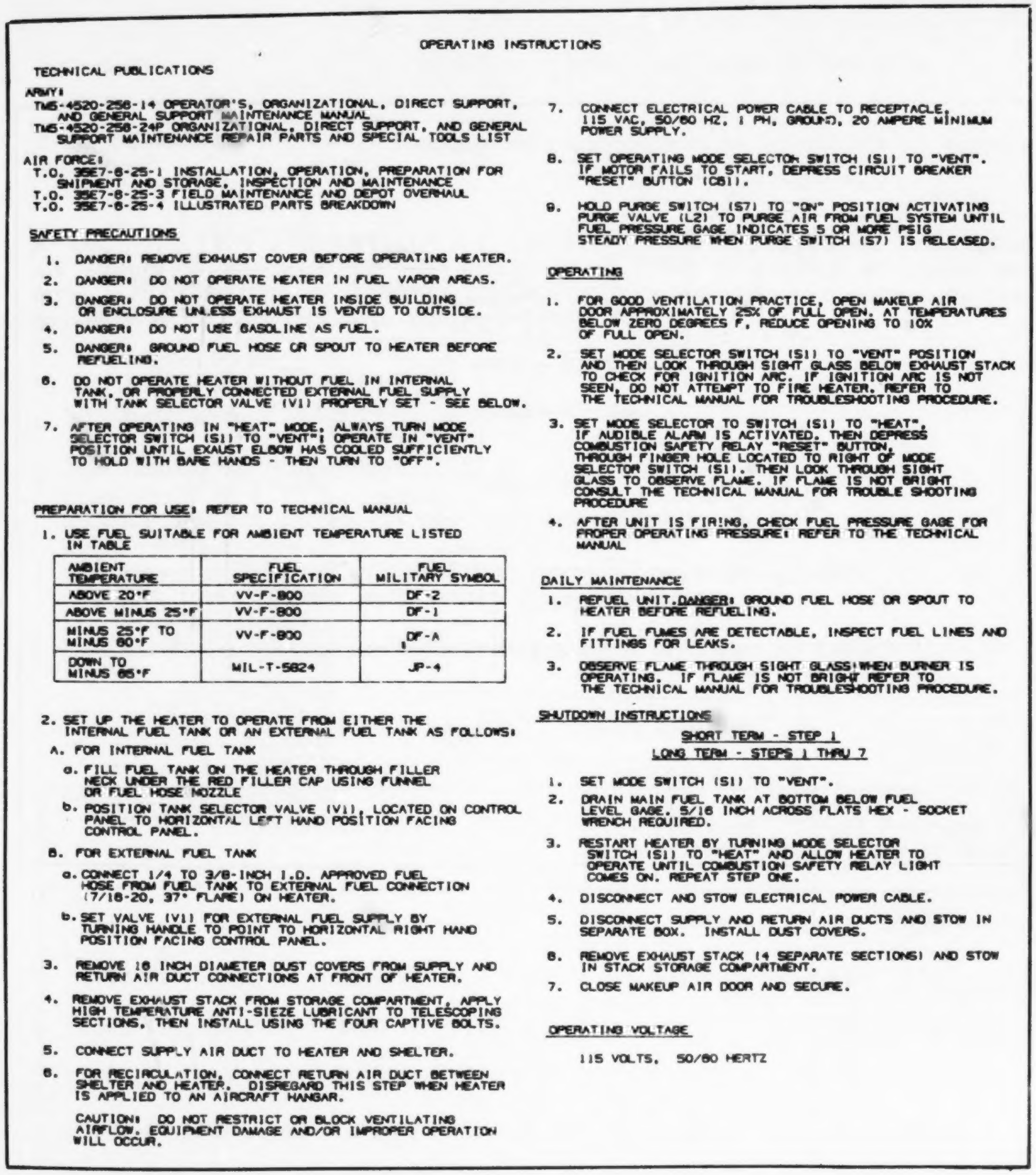
CAUTION

When cooling aids are not available, it is best to leave the heater unit stand idle for 15 to 30 minutes with the ducts removed and the makeup air door open. In that length of time, the residual heat in the heat exchanger will have dissipated and the heater unit can be restarted when power is available.

(1) If OFF/VENT/HEAT selector switch S1 (5) is not set on VENT, place it into VENT position and wait for three minutes.

(2) Set the OFF/VENT/HEAT selector switch S7 (5) to OFF to shutdown unit.

2-8. OPERATING INSTRUCTIONS ON DECALS AND INSTRUCTION PLATES. (Refer to Figures 2-10 and 2-11).



OPERATING INSTRUCTIONS

TECHNICAL PUBLICATIONS

ARMY:

TM5-4520-256-14 OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL

TM5-4520-256-24P ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LIST

AIR FORCE:

T.O. 35E7-6-25-1 INSTALLATION, OPERATION, PREPARATION FOR SHIPMENT AND STORAGE, INSPECTION AND MAINTENANCE

T.O. 35E7-6-25-3 FIELD MAINTENANCE AND DEPOT OVERHAUL

T.O. 35E7-6-25-4 ILLUSTRATED PARTS BREAKDOWN

SAFETY PRECAUTIONS

1. DANGER: REMOVE EXHAUST COVER BEFORE OPERATING HEATER.
2. DANGER: DO NOT OPERATE HEATER IN FUEL VAPOR AREAS.
3. DANGER: DO NOT OPERATE HEATER INSIDE BUILDING OR ENCLOSURE UNLESS EXHAUST IS VENTED TO OUTSIDE.
4. DANGER: DO NOT USE GASOLINE AS FUEL.
5. DANGER: GROUND FUEL HOSE OR SPOUT TO HEATER BEFORE REFUELING.
6. DO NOT OPERATE HEATER WITHOUT FUEL IN INTERNAL TANK, OR PROPERLY CONNECTED EXTERNAL FUEL SUPPLY WITH TANK SELECTOR VALVE (V1) PROPERLY SET - SEE BELOW.
7. AFTER OPERATING IN "HEAT" MODE, ALWAYS TURN MODE SELECTOR SWITCH (S1) TO "VENT"; OPERATE IN "VENT" POSITION UNTIL EXAUST ELBOW HAS COOLED SUFFICIENTLY TO HOLD WITH BARE HANDS - THEN TURN TO "OFF".

PREPARATION FOR USE: REFER TO TECHNICAL MANUAL

1. USE FUEL SUITABLE FOR AMBIENT TEMPERATURE LISTED IN TABLE

AMBIENT TEMPERATURE	FUEL SPECIFICATION	FUEL MILITARY SYMBOL
ABOVE 20°F	VV-F-800	DF-2
ABOVE MINUS 25°F	VV-F-800	DF-1
MINUS 25°F TO MINUS 60°F	VV-F-800	DF-A
DOWN TO MINUS 65°F	MIL-T-5624	JP-4

2. SET UP THE HEATER TO OPERATE FROM EITHER THE INTERNAL FUEL TANK OR AN EXTERNAL FUEL TANK AS FOLLOWS:
   - A. FOR INTERNAL FUEL TANK
     - a. FILL FUEL TANK ON THE HEATER THROUGH FILLER NECK UNDER THE RED FILLER CAP USING FUNNEL OR FUEL HOSE NOZZLE
     - b. POSITION TANK SELECTOR VALVE (V1), LOCATED ON CONTROL PANEL TO HORIZONTAL LEFT HAND POSITION FACING CONTROL PANEL.
   - B. FOR EXTERNAL FUEL TANK
     - a. CONNECT 1/4 TO 3/8-INCH I.D. APPROVED FUEL HOSE FROM FUEL TANK TO EXTERNAL FUEL CONNECTION (7/16-20, 37° FLARE) ON HEATER.
     - b. SET VALVE (V1) FOR EXTERNAL FUEL SUPPLY BY TURNING HANDLE TO POINT TO HORIZONTAL RIGHT HAND POSITION FACING CONTROL PANEL.
3. REMOVE 16 INCH DIAMETER DUST COVERS FROM SUPPLY AND RETURN AIR DUCT CONNECTIONS AT FRONT OF HEATER.
4. REMOVE EXHAUST STACK FROM STORAGE COMPARTMENT, APPLY HIGH TEMPERATURE ANTI-SIEZE LUBRICANT TO TELESCOPING SECTIONS, THEN INSTALL USING THE FOUR CAPTIVE BOLTS.
5. CONNECT SUPPLY AIR DUCT TO HEATER AND SHELTER.
6. FOR RECIRCULATION, CONNECT RETURN AIR DUCT BETWEEN SHELTER AND HEATER. DISREGARD THIS STEP WHEN HEATER IS APPLIED TO AN AIRCRAFT HANGAR.

   CAUTION: DO NOT RESTRICT OR BLOCK VENTILATING AIRFLOW. EQUIPMENT DAMAGE AND/OR IMPROPER OPERATION WILL OCCUR.
7. CONNECT ELECTRICAL POWER CABLE TO RECEPTACLE, 115 VAC, 50/60 HZ, 1 PH, GROUND, 20 AMPERE MINIMUM POWER SUPPLY.
8. SET OPERATING MODE SELECTOR SWITCH (S1) TO "VENT". IF MOTOR FAILS TO START, DEPRESS CIRCUIT BREAKER "RESET" BUTTON (CB1).
9. HOLD PURGE SWITCH (S7) TO "ON" POSITION ACTIVATING PURGE VALVE (L2) TO PURGE AIR FROM FUEL SYSTEM UNTIL FUEL PRESSURE GAGE INDICATES 5 OR MORE PSIG STEADY PRESSURE WHEN PURGE SWITCH (S7) IS RELEASED.

OPERATING

1. FOR GOOD VENTILATION PRACTICE, OPEN MAKEUP AIR DOOR APPROXIMATELY 25% OF FULL OPEN. AT TEMPERATURES BELOW ZERO DEGREES F, REDUCE OPENING TO 10% OF FULL OPEN.
2. SET MODE SELECTOR SWITCH (S1) TO "VENT" POSITION AND THEN LOOK THROUGH SIGHT GLASS BELOW EXHAUST STACK TO CHECK FOR IGNITION ARC. IF IGNITION ARC IS NOT SEEN, DO NOT ATTEMPT TO FIRE HEATER. REFER TO THE TECHNICAL MANUAL FOR TROUBLESHOOTING PROCEDURE.
3. SET MODE SELECTOR TO SWITCH (S1) TO "HEAT". IF AUDIBLE ALARM IS ACTIVATED. THEN DEPRESS COMBUSTION SAFETY RELAY "RESET" BUTTON, THROUGH FINGER HOLE LOCATED TO RIGHT OF MODE SELECTOR SWITCH (S1). THEN LOOK THROUGH SIGHT GLASS TO OBSERVE FLAME. IF FLAME IS NOT BRIGHT CONSULT THE TECHNICAL MANUAL FOR TROUBLE SHOOTING PROCEDURE
4. AFTER UNIT IS FIRING, CHECK FUEL PRESSURE GAGE FOR PROPER OPERATING PRESSURE: REFER TO THE TECHNICAL MANUAL

DAILY MAINTENANCE

1. REFUEL UNIT. DANGER: GROUND FUEL HOSE OR SPOUT TO HEATER BEFORE REFUELING.
2. IF FUEL FUMES ARE DETECTABLE, INSPECT FUEL LINES AND FITTINGS FOR LEAKS.
3. OBSERVE FLAME THROUGH SIGHT GLASS WHEN BURNER IS OPERATING. IF FLAME IS NOT BRIGHT REFER TO THE TECHNICAL MANUAL FOR TROUBLESHOOTING PROCEDURE.

SHUTDOWN INSTRUCTIONS

SHORT TERM - STEP 1

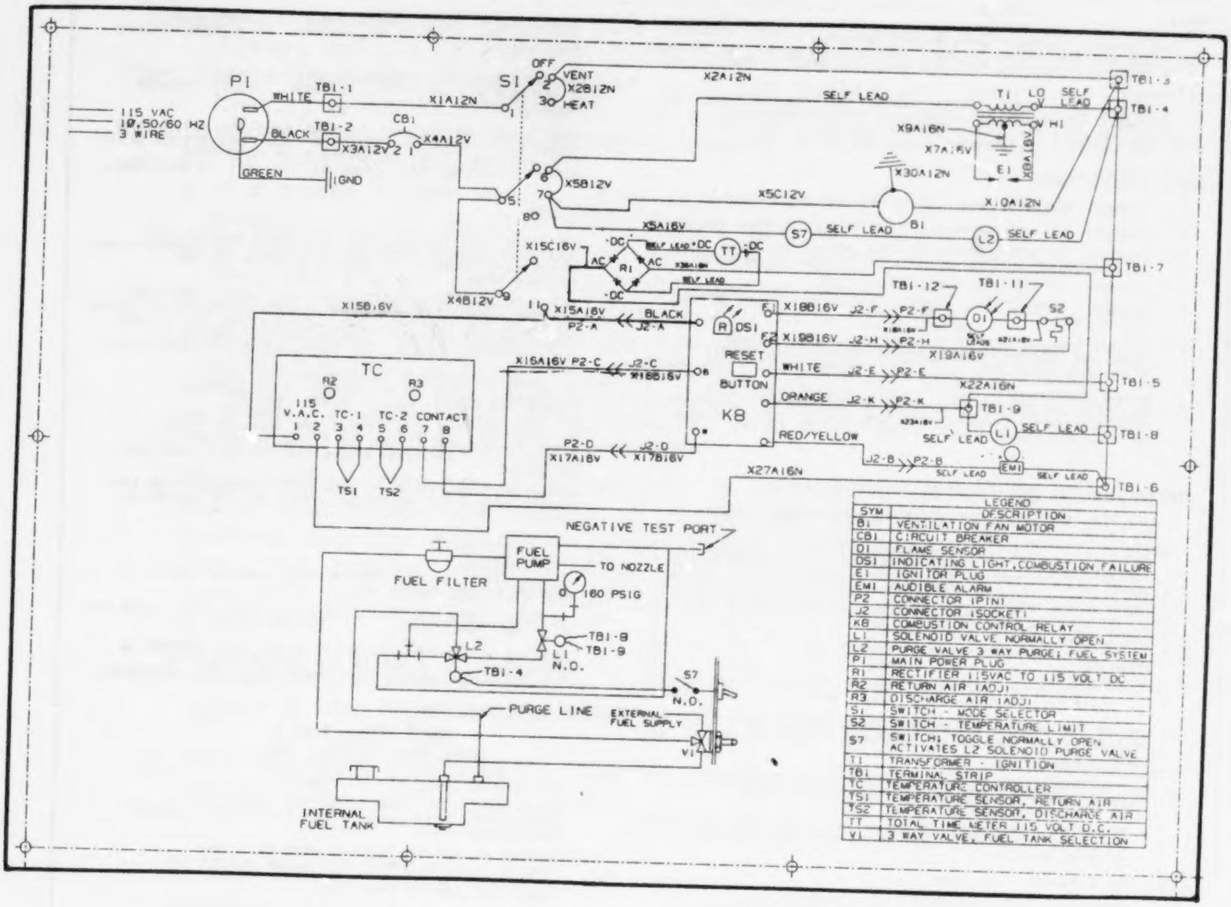
LONG TERM - STEPS 1 THRU 7

1. SET MODE SWITCH (S1) TO "VENT".
2. DRAIN MAIN FUEL TANK AT BOTTOM BELOW FUEL LEVEL GAGE. 5/16 INCH ACROSS FLATS HEX - SOCKET WRENCH REQUIRED.
3. RESTART HEATER BY TURNING MODE SELECTOR SWITCH (S1) TO "HEAT" AND ALLOW HEATER TO OPERATE UNTIL COMBUSTION SAFETY RELAY LIGHT COMES ON. REPEAT STEP ONE.
4. DISCONNECT AND STOW ELECTRICAL POWER CABLE.
5. DISCONNECT SUPPLY AND RETURN AIR DUCTS AND STOW IN SEPARATE BOX. INSTALL DUST COVERS.
6. REMOVE EXHAUST STACK (4 SEPARATE SECTIONS) AND STOW IN STACK STORAGE COMPARTMENT.
7. CLOSE MAKEUP AIR DOOR AND SECURE.

OPERATING VOLTAGE

115 VOLTS, 50/60 HERTZ

Figure 2-10. Instruction Plate, Operating Instructions.


P1
115 VAC
10,50/60 HZ
3 WIRE
WHITE
BLACK
GREEN
GND
TB1-1
TB1-2
X1A12N
CB1
X3A12V
X4A12V
S1
OFF
VENT
HEAT
X2B12N
X5B12V
X15C16V
X4B12V
X15B16V
X15A16V
P2-A
J2-A
BLACK
X2A12N
SELF LEAD
T1
LO
HI
X9A16N
X7A16V
X8A16V
E1
X30A12N
X5C12V
B1
X10A12N
X5A16V
S7
L2
R1
AC
DC
TT
TB1-3
TB1-4
TB1-7
TB1-12
TB1-11
D1
S2
DS1
RESET BUTTON
K8
X18B16V
X19B16V
X19A16V
J2-F
P2-F
J2-H
P2-H
WHITE
J2-E
P2-E
X22A16N
TB1-5
ORANGE
J2-K
P2-K
X23A16V
TB1-9
L1
TB1-8
RED/YELLOW
J2-B
P2-B
EM1
TB1-6
X27A16N
TC
R2
R3
115 V.A.C.
TC-1
TC-2
CONTACT
1 2 3 4 5 6 7 8
TS1
TS2
X16A16V
P2-C
J2-C
X18B16V
P2-D
J2-D
X17A16V
X17B16V
NEGATIVE TEST PORT
FUEL PUMP
FUEL FILTER
TO NOZZLE
160 PSIG
TB1-8
TB1-9
L1 N.O.
TB1-4
S7 N.O.
PURGE LINE
EXTERNAL FUEL SUPPLY
V1
INTERNAL FUEL TANK

LEGEND	
SYM	DESCRIPTION
B1	VENTILATION FAN MOTOR
CB1	CIRCUIT BREAKER
D1	FLAME SENSOR
DS1	INDICATING LIGHT, COMBUSTION FAILURE
E1	IGNITOR PLUG
EM1	AUDIBLE ALARM
P2	CONNECTOR (PIN)
J2	CONNECTOR (SOCKET)
K8	COMBUSTION CONTROL RELAY
L1	SOLENOID VALVE NORMALLY OPEN
L2	PURGE VALVE 3 WAY PURGE; FUEL SYSTEM
P1	MAIN POWER PLUG
R1	RECTIFIER 115VAC TO 115 VOLT DC
R2	RETURN AIR (ADJ)
R3	DISCHARGE AIR (ADJ)
S1	SWITCH - MODE SELECTOR
S2	SWITCH - TEMPERATURE LIMIT
S7	SWITCH; TOGGLE NORMALLY OPEN ACTIVATES L2 SOLENOID PURGE VALVE
T1	TRANSFORMER - IGNITION
TB1	TERMINAL STRIP
TC	TEMPERATURE CONTROLLER
TS1	TEMPERATURE SENSOR, RETURN AIR
TS2	TEMPERATURE SENSOR, DISCHARGE AIR
TT	TOTAL TIME METER 115 VOLT D.C.
V1	3 WAY VALVE, FUEL TANK SELECTION

Figure 2-11. Instruction Plate, Piping and Wiring.

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

	Para.		Para.
Introduction	2-9	Heater Operation at Elevations	2-10

2-9. INTRODUCTION. These procedures consist of operations at varying elevations.

2-10. HEATER OPERATION AT VARYING ELEVATIONS. Combustion air supply is adequate for elevations up to 6,000 ft (1829.3 m) above sea level. For operation at different elevations, it is necessary to adjust the fuel pressure as follows (refer to Figure 2-12).

a. Open access panel (5).

b. Remove air filters (1).

c. Remove hex fitting (3) from the side of fuel pump (2).

d. Use screw driver to adjust fuel pressure by rotating screw (4). Adjust fuel pressure until heater stops smoking.

e. Set fuel pressure for indicated elevations as shown in Table 2-4.

Table 2-4. Fuel Pressure Settings

Elevation	Fuel Pressure Setting at 60 Hz	Fuel Pressure Setting at 50 Hz
Sea level to 1000 ft (304.8 m)	130 - 125*	125 - 120
1000 ft (304.8 m) - 2000 ft (609.7 m)	125 - 120	120 - 115
2000 ft (609.8 m) - 3000 ft (914.6 m)	120 - 115	115 - 110
3000 ft (914.6 m) - 4000 ft (1219.6 m)	115 - 110	110 - 100
4000 ft (1219.6 m) - 5000 ft (1524.4 m)	110 - 100	100 - 90
5000 ft (1524.4 m) - 6000 ft (1829.3 m)	100 - 90	90 - 80
	* Factory Setting	

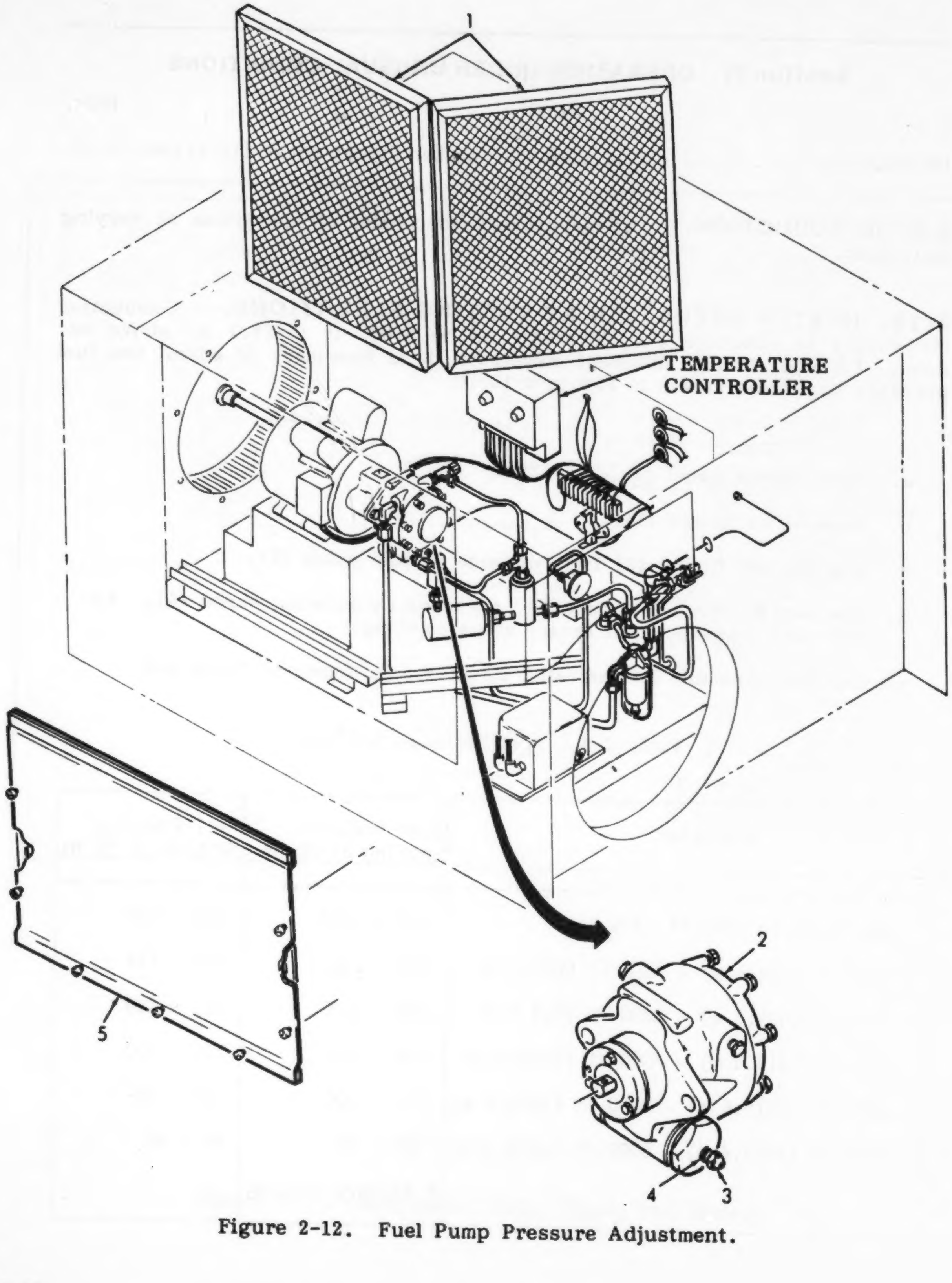

1
TEMPERATURE CONTROLLER
2
3
4
5

Figure 2-12. Fuel Pump Pressure Adjustment.

CHAPTER 3

UNIT MAINTENANCE INSTRUCTIONS

Section I. Lubrication Instructions
Section II. Repair Parts, Special Tools, and Support Equipment
Section III. Service Upon Receipt of Equipment
Section IV. Preventive Maintenance Checks and Services (PMCS)
Section V. Troubleshooting
Section VI. Maintenance Instructions
Section VII. Preparation for Storage or Shipment

Section I. LUBRICATION INSTRUCTIONS

Para.

General.........................3-1

3-1. GENERAL.

The heater unit does not require periodic lubrication of its components.

Section II. REPAIR PARTS, SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

Para.

Common Tools and Equipment.......3-2
Special Tools, TMDE, and Support Equipment......................3-3
Repair Parts..................3-4

3-2. COMMON TOOLS AND EQUIPMENT. For authorized common tools and equipment, refer to the Modified Table or Organization and Equipment (MTOE) applicable to your unit.

3-3. SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT. Special tools required for unit maintenance are listed and illustrated in the Repair Parts and Special Tools List TM 5-4520-256-24P covering unit maintenance. TMDE and support equipment are listed in the MAC.

3-4. REPAIR PARTS. Repair parts are listed and illustrated in the Repair Parts and Special Tools List TM 5-4520-256-24P covering unit maintenance for this equipment.

Section III. SERVICE UPON RECEIPT OF EQUIPMENT

Para.
Service Upon Receipt of Materiel............................3-5

3-5. SERVICE UPON RECEIPT OF MATERIEL.

a. Unpacking Equipment. (Refer to Figure 3-1).

WARNING

Steel banding, cut under tension, can snap free and cause injury. Leather gloves and face shield are required.

CAUTION

Be careful when unpacking heater to avoid damage to equipment. Do not slide one heater unit across the top of another. Lift it off if stacked vertically. Do not stand or sit on top of heater unit. Failure to comply may result in damage to equipment.

NOTE

The wooden shipping skid and vinyl protective sheet are used when shipped to first destination. Thereafter, use of the skid and vinyl cover are optional.

(1) Cut metal bands (2) and remove vinyl cover (3).

(2) If heater units are received in the stacked configuration, remove four stacking bolts (4) and remove top heater unit. Repeat until bottom unit is reached.

(3) Remove four bolts securing heater unit to shipping skid (5).

(4) Remove any tape or protective material from exterior surfaces of heater unit(s).

(5) Remove heater air ducts from shipping containers (1). Save containers for reuse.

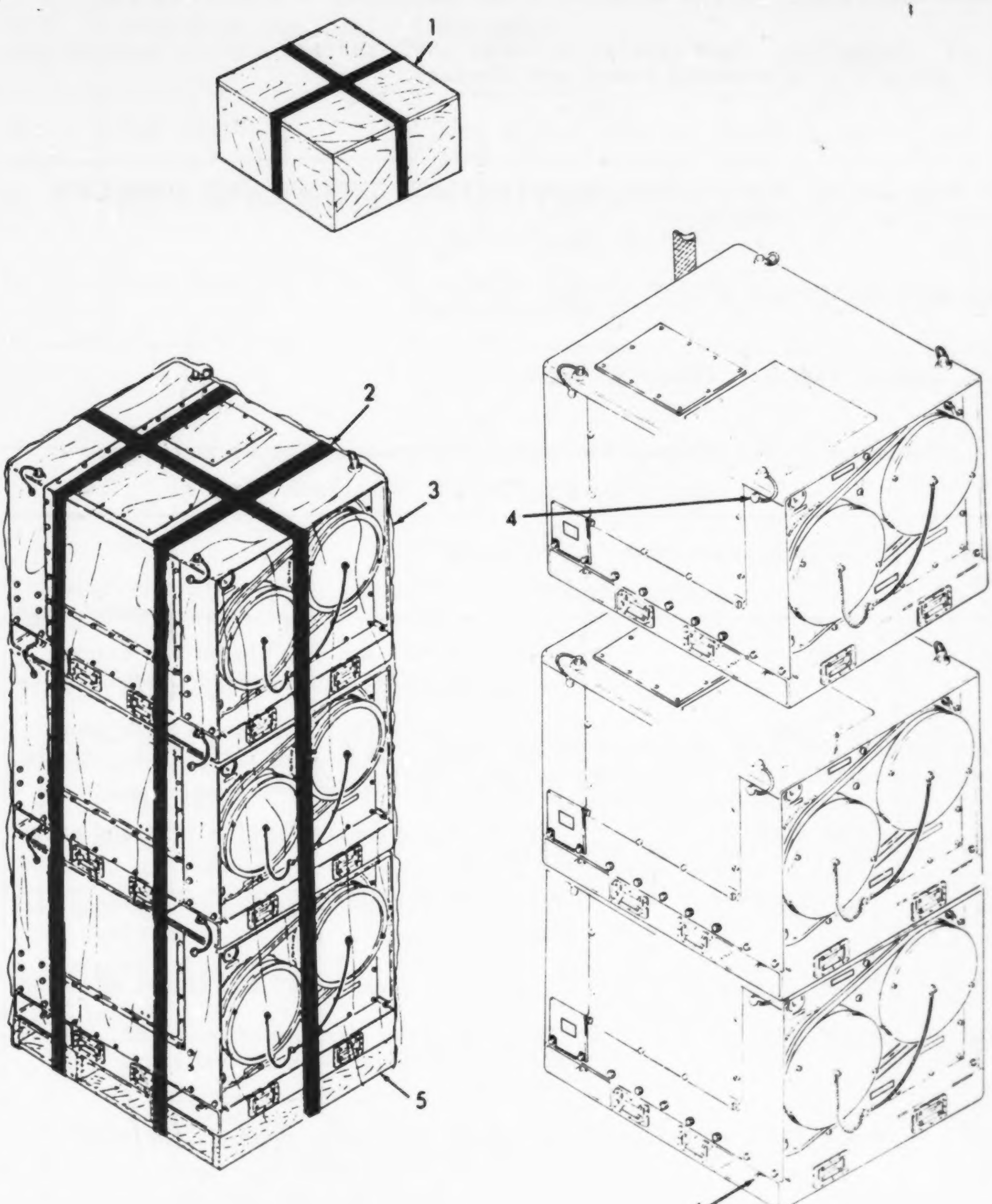


Figure 3-1. Heater Unit Packaging.

3-5. SERVICE UPON RECEIPT OF MATERIEL - Continued.

b. Inspection. Upon receipt of heater unit, perform both the operator and unit preventive maintenance checks and services.

Section IV. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

Para.

Unit PMCS......................3-6

3-6. UNIT PMCS. (Refer to Table 3-1).

Table 3-1. Unit Monthly Preventive Maintenance Checks and Services

Item No.	Item To Be Inspected	Procedure
1	Blower	Inspect scroll and fan blower for cracks, corrosion, holes, and general cleanliness.
2	Fuel Pump	Inspect fuel pump for leaks, secure mounting. Remove and clean fuel filter per the procedure in Section IV.
3	Flame Detector	Inspect for cleanliness of window and secure mounting.
4	Electrodes	Inspect for cleanliness and secure mounting. Check for signs of pitting or burning.
5	Burner Nozzle	Inspect for cleanliness and secure mounting.
6	Motor	Check shaft for freedom of movement. Inspect slip rings for wear and signs of burning.
7	Power Cable Assembly	Perform a continuity check of the power cable individual wires.
8	Combustion Air Plenum	Inspect combustion air plenum for holes, loose mounting, missing hardware, or corrosion.
9	Burner Assembly	Inspect burner assembly for holes, loose mounting, missing, hardware, or corrosion.

Item No.	Item To Be Inspected	Procedure
10	Fuel Tank	Inspect fuel tank for leaks, missing hardware, or corrosion.
11	Fuel Tube Assemblies	Inspect tube assemblies for loose mounting, leaks, or corrosion.
12	Frame Skid	Inspect skid for cracks, secure mounting, and corrosion.

Section V. TROUBLESHOOTING

Para.
Introductory Information.........3-7
Symptom Index....................3-8
Para.
Troubleshooting................3-9

3-7. INTRODUCTORY INFORMATION.

a. The table lists the common malfunctions which you may find during the operation or maintenance of the heater or its components. You should perform the tests/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by the listed corrective actions, notify your supervisor.

3-8. SYMPTOM INDEX.

Malfunction No.	Malfunction	Page
6	Burner smokes excessively	3-10
1	Centrifugal fan fails to start	3-6
3	Fuel pressure fails to rise (Heat Mode)	3-7
5	High fuel pressure	3-9
4	Low fuel pressure	3-8
8	No ignition	3-11
7	Return air temperature is higher or lower than desired	3-10
2	SAFETY RELEASE indicator light illuminates	3-7

3-9. TROUBLESHOOTING. (Refer to Table 3-2).

Table 3-2. Unit Troubleshooting

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

1. CENTRIFUGAL FAN FAILS TO OPERATE.

WARNING

Be careful when working with live electrical circuits to prevent contacting electrical voltages which could cause death or serious injury. Personnel should stand on "High voltage" switchboard matting (Federal Specification ZZ-M-81A), 3/16 inch (4.8 mm) or greater, to avoid being grounded.

Step 1. Check for 120(+/-10)Vac, 50/60 Hz, 20/25 fused circuit breaker protected electrical power is available at shelter electrical receptacle.

If 120(+/-10)Vac is not present, troubleshoot and repair shelter electrical system.

If 120(+/-10)Vac is present, proceed to step 2.

Step 2. Check for 120(+/-10)Vac at TB1, terminals 1 and 2.

If voltage is not present at TB1, terminals 1 and 2, replace power cable (para 3-29).

If voltage is present and proper, proceed to step 3.

Step 3. Check for 120(+/-10)Vac between TB1 terminal 1 and terminal 1 of circuit breaker (CB1) after resetting the circuit breaker.

If voltage is not present (indicating circuit breaker controls are still open) replace circuit breaker (CB1) (para 3-19).

If voltage is present and proper, proceed to step 4.

Step 4. Check for 120(+/-10)Vac between terminal 5 and terminal 6 of OFF/VENT/HEAT switch (S1), with switch in VENT position.

If voltage is present (indicating open contacts), replace selector switch S1 (para 3-14).

If voltage is not present proceed to step 5.

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 5. Check for 120(+/-10)Vac at terminal 7 of OFF/VENT/HEAT switch (S1) and TB1, terminal 3.

If voltage is present (indicating open motor windings), notify Direct Support Maintenance.

2. SAFETY RELEASE INDICATOR LIGHT IS ILLUMINATED AND AUDIBLE ALARM IS SOUNDING.

Step 1. Set OFF/VENT/HEAT switch (S1) to OFF and reset combustion control relay K8.

Step 2. Check that fuel being used is proper for the ambient temperature per Table 1-1.

If fuel is not proper, proceed to MALFUNCTION 10.

Step 3. Check that fuel tank contains fuel.

If fuel tank is out of fuel, fill tank with proper fuel.

If fuel tank contains fuel, proceed to step 4.

Step 4. With switch (S1) set to VENT purge the fuel system of air (para 1-14b).

If system does not purge, check for loose fuel connections between fuel tank and pump.

If system purges, proceed to step 5.

Step 5. With switch (S1) set to VENT, observe through sightglass for spark at burner.

If spark is not visible, proceed to MALFUNCTION 8.

If spark is visible, proceed to step 6.

Step 6. Set OFF/VENT/HEAT switch (S1) to HEAT, reset combustion control relay K8 and observe fuel pressure.

If audible alarm sound immediately, proceed to step 8.

If fuel pressure fails to rise to nominal, proceed to MALFUNCTION 3.

If fuel pressure rises, proceed to step 7.

3-9. TROUBLESHOOTING - Continued.

Table 3-2. Unit Troubleshooting - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

2. SAFETY RELEASE INDICATOR LIGHT IS ILLUMINATED AND AUDIBLE ALARM IS SOUNDING - Continued.

Step 7. With switch (S1) set to HEAT mode, observe through sightglass for flame.

If audible alarm sounds, set (S1) to VENT, wait approximately 60 seconds, reset combustion control relay K8 and set (S1) to HEAT mode. Check for flame within 10 seconds.

If audible alarm sound immediately, proceed to step 8.

If flame is not present, clean or replace fuel nozzle as needed (para 3-39).

If flame is visible and audible alarm sound after 10 seconds, proceed to step 8.

Step 8. Inspect flame detector (para 3-37).

If malfunction still exists, proceed to step 9.

Step 9. Inspect high temperature safety thermostat (para 3-27).

If malfunction still exists, replace combustion control relay K8.

3. FUEL PRESSURE FAILS TO RISE (HEAT MODE).

Step 1. Check that INTERNAL TANK/EXTERNAL TANK selector switch is set for proper tank being used.

If switch is improperly set, correctly set switch.

If switch is properly set, proceed to step 2.

Step 2. With OFF/VENT/HEAT switch (S1) set to VENT mode check that fan is operating.

If fan fails to operate, proceed to MALFUNCTION 1.

If fan is operating, proceed to step 3.

Step 3. With (S1) in VENT mode, check that the fuel system is properly purged of air (para 1-14b).

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

If fuel pressure rises, unit is functional.

If fuel pressure fails to rise, proceed to step 4.

Step 4. With (S1) in VENT mode, check that fuel pump is operating.

If motor shaft (pump side) or coupling is broken, notify Intermediate Direct Support Maintenance.

If pump is operating, proceed to step 5.

Step 5. Check for clogged fuel filter.

If fuel filter is clogged, service fuel filter (para 3-35).

If fuel filter is not clogged, proceed to step 6.

Step 6. With (S1) in VENT mode, check operation of solenoid valve L2.

If fuel pressure lowers with switch S7 ON and rises to 10 to 20 PSI with S7 OFF, L2 is operating properly, proceed to step 7.

If L2 is not operating properly, replace valve (para 3-34).

Step 7. Check for 120(±10) Vac between TB1-9 and TB1-8 with switch (S1) set to HEAT mode.

If voltage is present, proceed to step 8.

If voltage is not present, proceed to step 9.

Step 8. Check that solenoid valve L1 has operated and is closed.

If valve has not operated when (S1) is set to HEAT mode, replace solenoid valve L1 (para 3-34).

If solenoid valve L1 has operated, and low fuel pressure still exists, replace fuel pump (para 3-24).

Step 9. Check that both thermostats on the temperature controller are set higher than ambient temperature.

Adjust as necessary and proceed to step 10.

Step 10. If the fuel pressure still fails to rise when OFF/VENT/HEAT switch (S1) is set to HEAT Mode, replace combustion control relay (K8) (para 3-17).

3-9. TROUBLESHOOTING - Continued.

Table 3-2. Unit Troubleshooting - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

4. LOW FUEL PRESSURE.

Step 1. Check fuel tank for fuel.

If fuel tank has improper amount of fuel, add fuel.

If fuel tank has proper amount of fuel, proceed to step 2.

Step 2. Check that INTERNAL TANK/EXTERNAL TANK selector switch is set for proper tank being used.

If selector switch is improperly set, correctly set switch.

If selector switch is properly set, proceed to step 3.

Step 3. Check fuel line for leaks or kinks.

If fuel line is kinked, remove kink.

If fuel line leaks, repair or replace fuel line (para 3-33).

If fuel line is not leaking or kinked, proceed to step 4.

Step 4. Check for jammed or damaged EXTERNAL TANK/INTERNAL TANK selector valve.

If valve does not rotate freely, replace valve (para 3-22).

If valve does not rotate freely, proceed to step 5.

Step 5. Check for moisture, frost, or ice in lines or fuel filter. Check fuel filter for clogging or extreme dirtiness.

If fuel has frost or ice, drain fuel lines.

If fuel filter is clogged or dirty, clean filter (para 3-35).

If moisture, ice, or dirt is not present, proceed to step 6.

Step 6. Check solenoid valve (L1) for leaks or defects.

If valve leaks or is defective, replace valve (para 3-34).

If valve does not leak or is not defective, proceed to step 7.

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 7. Check fuel pressure gage for leaks, defects, or indicating error.

If fuel pressure gage is defective, replace fuel gage (para 3-15).

If fuel gage is not defective, proceed to step 8.

Step 8. Re-adjust fuel pump fuel pressure (para 3-24).

If fuel pump cannot be adjusted to maintain the pressure, notify Intermediate Direct Support Maintenance.

5. HIGH FUEL PRESSURE.

Step 1. Adjust fuel pump fuel pressure (para 3-24).

If fuel pump cannot be adjusted to maintain the required pressure, notify Intermediate Direct Support Maintenance.

Step 2. Check fuel pressure gage for damage.

If fuel gage is damaged or defective, replace fuel pressure gage (para 3-15).

6. BURNER SMOKES EXCESSIVELY.

Step 1. Check burner combustion air plenum cover for looseness.

If cover is loose, tighten fasteners on cover.

If cover is not loose, proceed to step 2.

Step 2. Check fuel pump adjustment (para 3-24).

If fuel pump is out of adjustment, adjust fuel pump (para 3-24).

If fuel pump cannot be adjusted, notify Intermediate Direct Support Maintenance.

7. RETURN AIR TEMPERATURE IS HIGHER OR LOWER THAN DESIRED.

Step 1. Check the fuel pressure for the proper setting (Table 1-1).

If fuel pressure is incorrect, adjust the pressure (para 3-24). Proceed to step 2.

3-9. TROUBLESHOOTING - Continued.

Table 3-2. Unit Troubleshooting - Continued

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

7. RETURN AIR TEMPERATURE IS HIGHER OR LOWER THAN DESIRED - Continued.

Step 2. Check the air temperature in the shelter at the return air duct hook-up.

If the air temperature is higher or lower than desired, proceed to step 3.

Step 3. Check the temperature adjustments on the temperature controller and adjust as necessary.

If adjustment of the thermostat does not correct the shelter temperature, proceed to MALFUNCTION 9.

8. NO SPARK AT BURNER.

Step 1. Set OFF/VENT/HEAT switch (S1) to VENT mode and observe for a spark at the burner through sightglass.

If spark is visible, unit is functional.

If no spark is visible, proceed to step 2.

Step 2. Set switch (S1) to the OFF position and disconnect the power cable. Proceed to step 3.

Step 3. Disconnect and tag the wiring lead from terminal 6 on (S1) going to the transformer. Proceed to step 4.

Step 4. Check continuity across ignition transformer primary leads (para 3-36).

If continuity check indicates an open circuit, replace transformer.

If continuity check indicates continuity, proceed to step 5.

Step 5. Reconnect wire lead disconnected in step 3 to terminal 6 at (S1). Proceed to step 6.

Step 6. Disconnect the high tension leads from the transformer and check for continuity across the secondary of the transformer.

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

If continuity check indicates an open circuit, replace the transformer.

If continuity check indicates continuity, proceed to step 7.

Step 7. Check for damaged high tension cables (para 3-30).

If the cables are damaged, repair or replace and proceed to step 8.

Step 8. Inspect burner electrodes and adjust for proper gap (para 3-38).

If electrodes are damaged, replace them.

If electrodes are out of adjustment, adjust electrodes.

9. THERMOSTATS DO NOT CONTROL THE BURNER OR SHELTER TEMPERATURE.

Step 1. Perform the steps of MALFUNCTION 7.

If the problem still exists, proceed to step 2.

Step 2. Remove and tag the wire leads on terminals 7 and 8 of the temperature controller. The leads are 28 Vac signal lines. Proceed to step 3.

Step 3. Connect the two wires removed in step 2 together. Proceed to step 4.

Step 4. Set OFF/VENT/HEAT switch (S1) to HEAT mode. The burner should be firing.

If the burner fires, proceed to step 5.

If the burner does not fire, replace safety relay (para 3-17).

Step 5. Set OFF/VENT/HEAT switch (S1) to OFF, disconnect the wires connected in step 3 and tape over the ends. With the ends disconnected set OFF/VENT/HEAT switch (S1) to HEAT mode. The burner should not fire.

If the burner does not fire, proceed to step 6.

If the burner fires, replace the safety relay (para 3-17).

Step 6. Set OFF/VENT/HEAT switch (S1) to OFF and connect the two wires removed in step 2 to terminals 7 and 8 of the temperature controller. Proceed to step 7.

3-9. TROUBLESHOOTING - Continued.

Table 3-2. Unit Troubleshooting - Continued

MALFUNCTION
    TEST OR INSPECTION
        CORRECTIVE ACTION

---

9. THERMOSTATS DO NOT CONTROL THE BURNER OR SHELTER TEMPERATURE - Continued.

Step 7. Set OFF/VENT/HEAT switch (S1) to HEAT mode.

If the ambient temperature is above 50°F, set the thermostats as low as possible to cycle the burner off.

If the burner cycles with the thermostats, the heater is functional.

If the burner does not cycle, replace the temperature controller (para 3-28).

If the ambient is too low to cycle the burner, proceed to step 8.

WARNING

While performing step 8, be careful when placing jumpers on contacts. Contacts 1 and 2 contain 115 Vac and can cause personnel injury or loss of life.

Step 8. Set OFF/VENT/HEAT switch (S1) to HEAT and place a small jumper wire between contacts 5 and 6 of the temperature controller to cause a short circuit. The burner should cycle off.

If the burner cycles off, the heater is functional.

If the burner does not cycle off, replace the temperature controller (para 3-28).

10. HEATER CONTAINS IMPROPER FUEL FOR THE AMBIENT TEMPERATURE.

Step 1. Attempt to start the heater.

If the heater will fire, even for only a few seconds, proceed to step 2.

If the heater will not fire at all, proceed to step 10.

Step 2. Disconnect the return and supply air ducts from the shelter. Proceed to step 3.

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

Step 3. Place the ends of the ducts close together to force warm air into the return air duct. Proceed to step 4.

Step 4. Connect the proper fuel supply to the external fuel port and place the EXTERNAL/INTERNAL fuel valve to the EXTERNAL fuel position. Proceed to step 5.

Step 5. Set OFF/VENT/HEAT switch (S1) to VENT mode and purge the system (para 1-14b) as well as possible. Proceed to step 6.

Step 6. Attempt to start the heater allowing warm air to enter the heater through the ductwork. Do not allow the inlet side of the heater to get above 100°F. Proceed to step 7.

Step 7. Repeat steps 5 and 6 until the heater pump, filter, and fuel lines have been purged of the improper fuel and the heater operates properly. Proceed to step 8.

Step 8. Raise the heater and drain the internal fuel tank. Proceed to step 9.

Step 9. Refill the heater with the proper fuel and proceed to step 10.

Step 10. If the heater will not fire at all, obtain another heater or heat source to blow warm air into the non functioning heater and perform steps 4 through 9 after the heater is warmed.

If another heater is unavailable, proceed to step 11.

Step 11. Move the heater to a warm location/building and allow the heater to thaw.

If it is not possible to move the heater proceed to step 19.

If the heater can be moved, proceed to step 12.

Step 12. After the heater thaws, lift the heater and drain the fuel cell. Proceed to step 13.

Step 13. Connect the proper fuel supply to the heater external fuel port and place the EXTERNAL/INTERNAL fuel valve to the EXTERNAL position. Proceed to step 14.

Step 14. Disconnect the fuel line to the nozzle and place the end into a container to catch fuel. Proceed to step 15.

Step 15. Supply 115 Vac to the heater and set the OFF/VENT/HEAT switch (S1) to the VENT mode and purge the fuel lines (para 1-14b) for at least two minutes. Proceed to step 16.

3-9. TROUBLESHOOTING - Continued.

Table 3-2. Unit Troubleshooting - Continued

MALFUNCTION
    TEST OR INSPECTION
        CORRECTIVE ACTION

---

10. HEATER CONTAINS IMPROPER FUEL FOR THE AMBIENT TEMPERATURE - Continued.

Step 16. Set OFF/VENT/HEAT switch (S1) to the HEAT mode for 20 seconds and catch the fuel from the fuel line. Proceed to step 17.

Step 17. Set OFF/VENT/HEAT switch (S1) to OFF. Proceed to step 18.

Step 18. Refuel the heater with proper fuel. The heater should be functional.

Step 19. If it is not possible to warm the heater by any means, the fuel lines, filter, and solenoid valves, and fuel pump will have to be removed and cleaned. Refer to the individual maintenance paragraphs in Section 3.

11. BURNER DOES NOT GO OFF WHEN HEATER IS SWITCHED TO VENT MODE. FUEL PRESSURE REMAINS HIGH.

Step 1. Set OFF/VENT/HEAT switch (S1) to OFF and quickly back to VENT. Fuel pressure should fall.

If burner remains on, proceed to step 2.

If burner goes off, allow heater to cool; shut down the heater and replace solenoid valve L1 (para 3-34).

Step 2. If the heater is operating from the internal tank, remove the cap from the external port and switch the EXTERNAL/INTERNAL valve to EXTERNAL and allow the heater to go off due to loss of fuel.

If the heater is operating from an external tank remove the fuel line and allow the heater to go off due to loss of fuel.

Section VI. MAINTENANCE PROCEDURES

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ON/OFF Toggle Switch Maintenance..........................3-20
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3-10. AIR FILTER MAINTENANCE.

This Task Covers:

a. Removal b. Cleaning c. Inspection d. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Cleaning Solvent (Item 11, Appendix E)

WARNING

Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.

a. Removal.

(1) Using a common screwdriver loosen seven quarter-turn fasteners (5).

(2) Remove access door (4).

(3) Lift up air filter (1) and pull out from bottom to remove filter from lower track (3).

(4) Lower air filter (1) in front of lower track (3) and top of filter is out of upper track.

(5) Lift filter (1) out of heater unit.

(6) Repeat steps (3 through 5) for other filter (2).

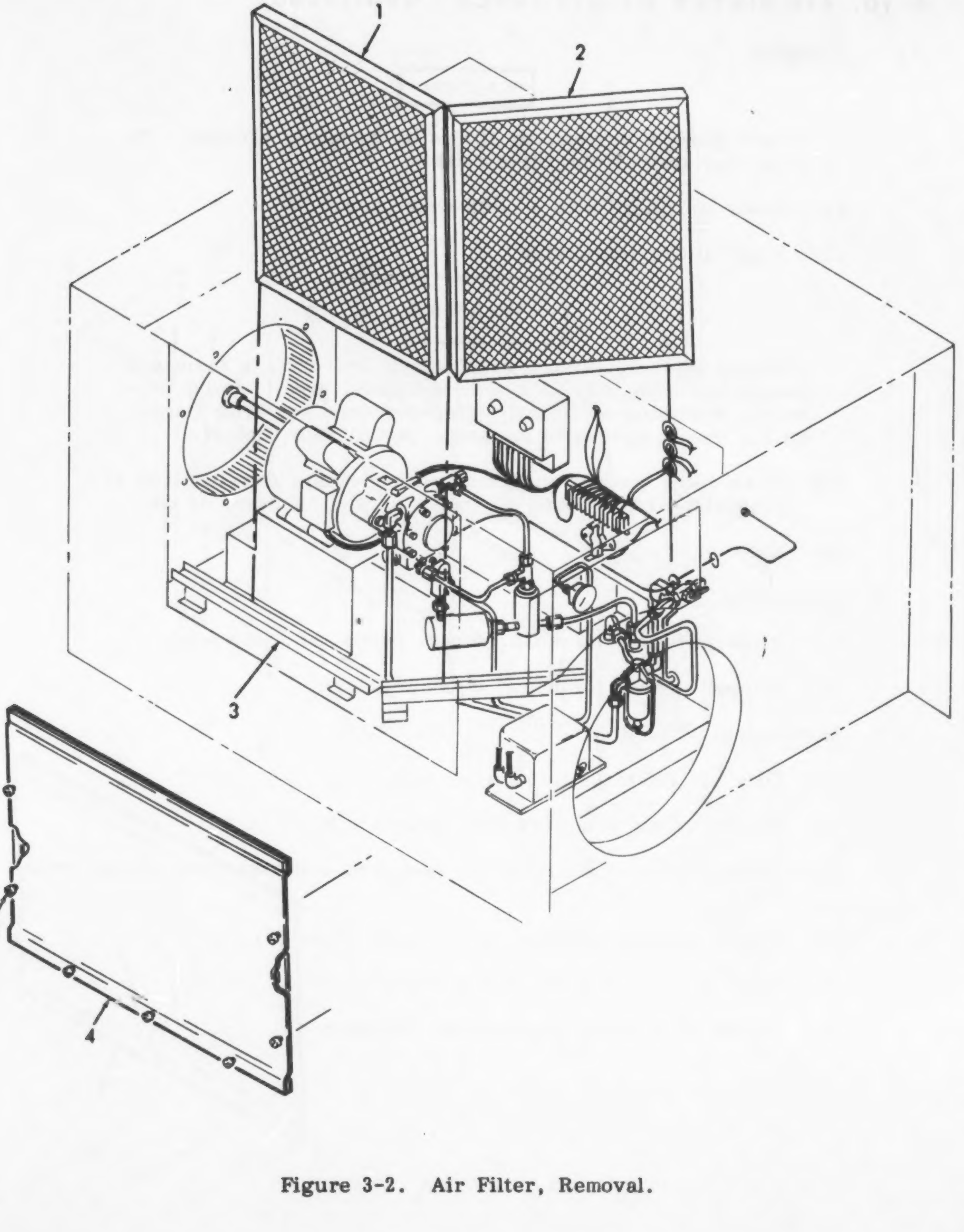

Figure 3-2. Air Filter, Removal.

3-10. AIR FILTER MAINTENANCE - Continued.

b. Cleaning.

CAUTION

Do not attempt to clean air filters by brushing off dirt. To do so may damage the filter element.

(1) Clean air filters with a clean water spray.

(2) Allow to dry thoroughly.

WARNING

Cleaning solvent, Federal specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

(3) Clean filter element and frame with cleaning solvent (item 11, Appendix E) to remove all traces or dirt, grease, or oil.

(4) Allow to dry.

c. Inspection.

(1) Inspect frame for cracks, dents, bends, and corrosion.

(2) Inspect element for holes, rips, and tears.

d. Installation.

(1) Place air filter (2) into heater unit.

(2) Put top of air filter (2) into upper track.

(3) Swing bottom of air filter (2) rearward and lower into bottom track (3).

(4) Repeat steps (1 through 3) for other filter (1).

(5) Place access cover (4) into position.

(6) Secure with seven quarter-turn fasteners (5).

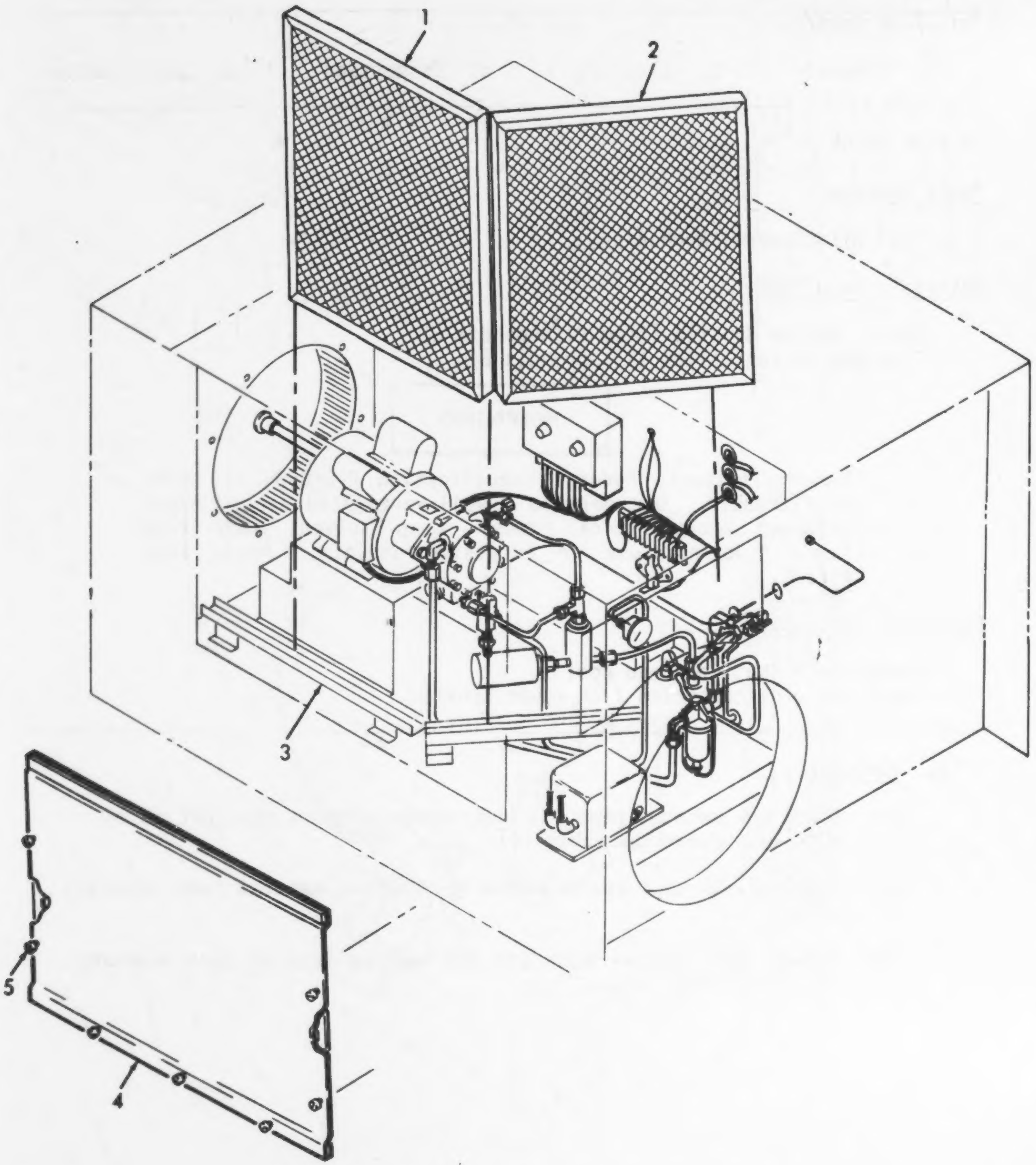

Figure 3-3. Air Filter, Installation.

3-11. EXHAUST PIPE MAINTENANCE.

This Task Covers:

a. Removal b. Cleaning c. Inspection d. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Brush, Medium Bristle (Item 2, Appendix E)
Cleaning Solvent (Item 11, Appendix E)

WARNING

Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.

a. **Removal.**

(1) Slide top exhaust pipe (2) and middle exhaust pipe (3) off of tube and guard assembly (4).

(2) Remove tube and guard assembly (4) from exhaust tube assembly (5).

(3) Loosen four captive bolts (6) and remove exhaust tube assembly (5) from heater unit.

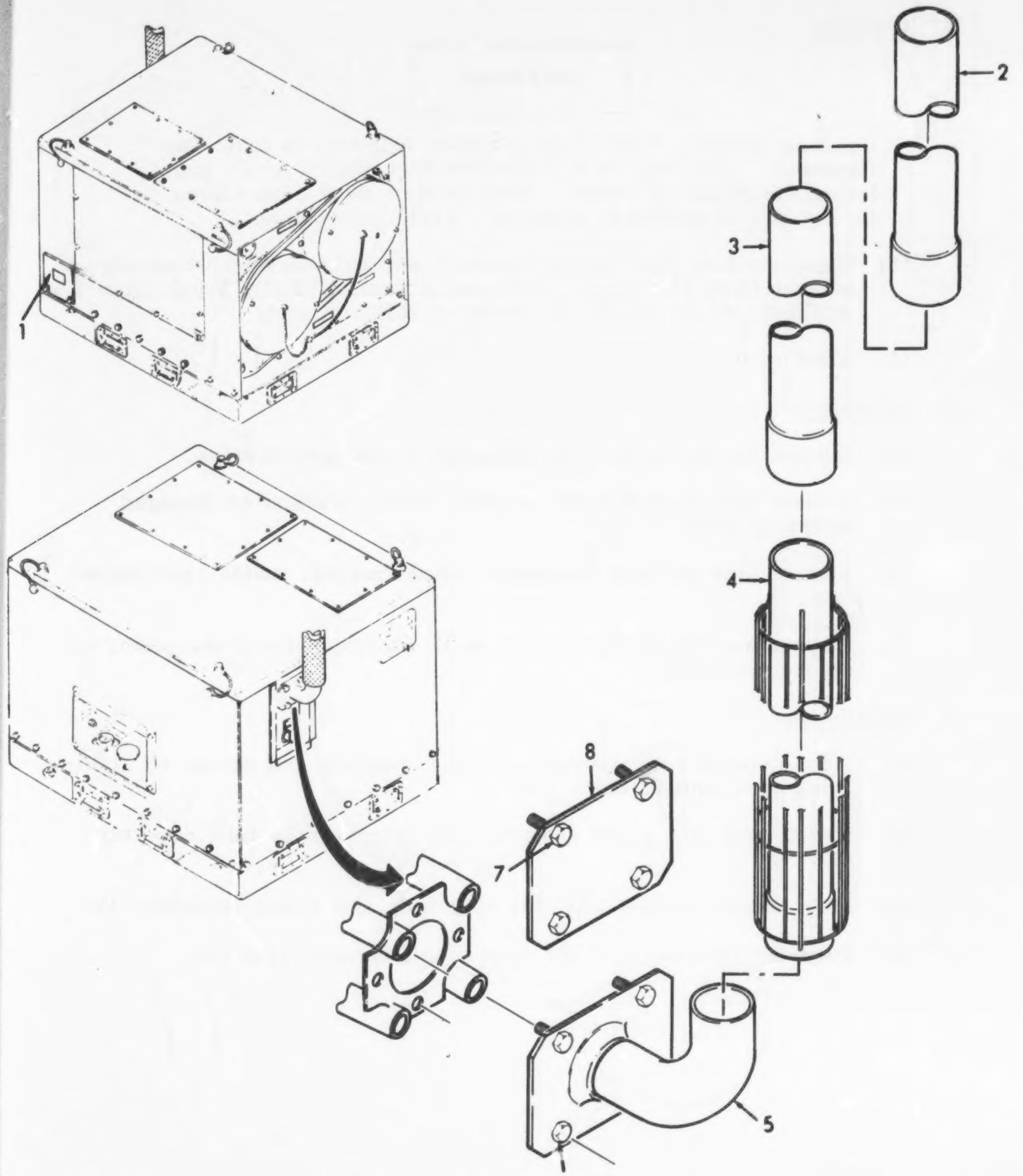

Figure 3-4. Exhaust Pipe, Assembly.

3-11. EXHAUST PIPE MAINTENANCE - Continued.

b. Cleaning.

WARNING

Cleaning solvent, Federal specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

(1) Clean exhaust pipe section interiors and exteriors with cleaning solvent (item 11, Appendix E) and a medium bristle brush (item 2, Appendix E) to remove all traces or dirt and soot.

(2) Allow to dry.

c. Inspection.

(1) Inspect captive screws for stripped or damaged threads.

(2) Inspect bottom section for cracked welds, cracked or damaged mounting plate.

(3) Inspect pipe sections for dents, holes, cracks, bends, and corrosion.

(4) Inspect heat guard for broken welds, broken wires, corrosion, and secure mounting.

d. Installation.

(1) Place exhaust tube assembly (5) into position and secure by tightening four captive bolts (6).

(2) Install tube and guard assembly (4) onto exhaust tube assembly (5).

(3) Slide middle exhaust pipe (3) onto tube and guard assembly (4).

(4) Slide top exhaust pipe (2) onto middle exhaust pipe (3).

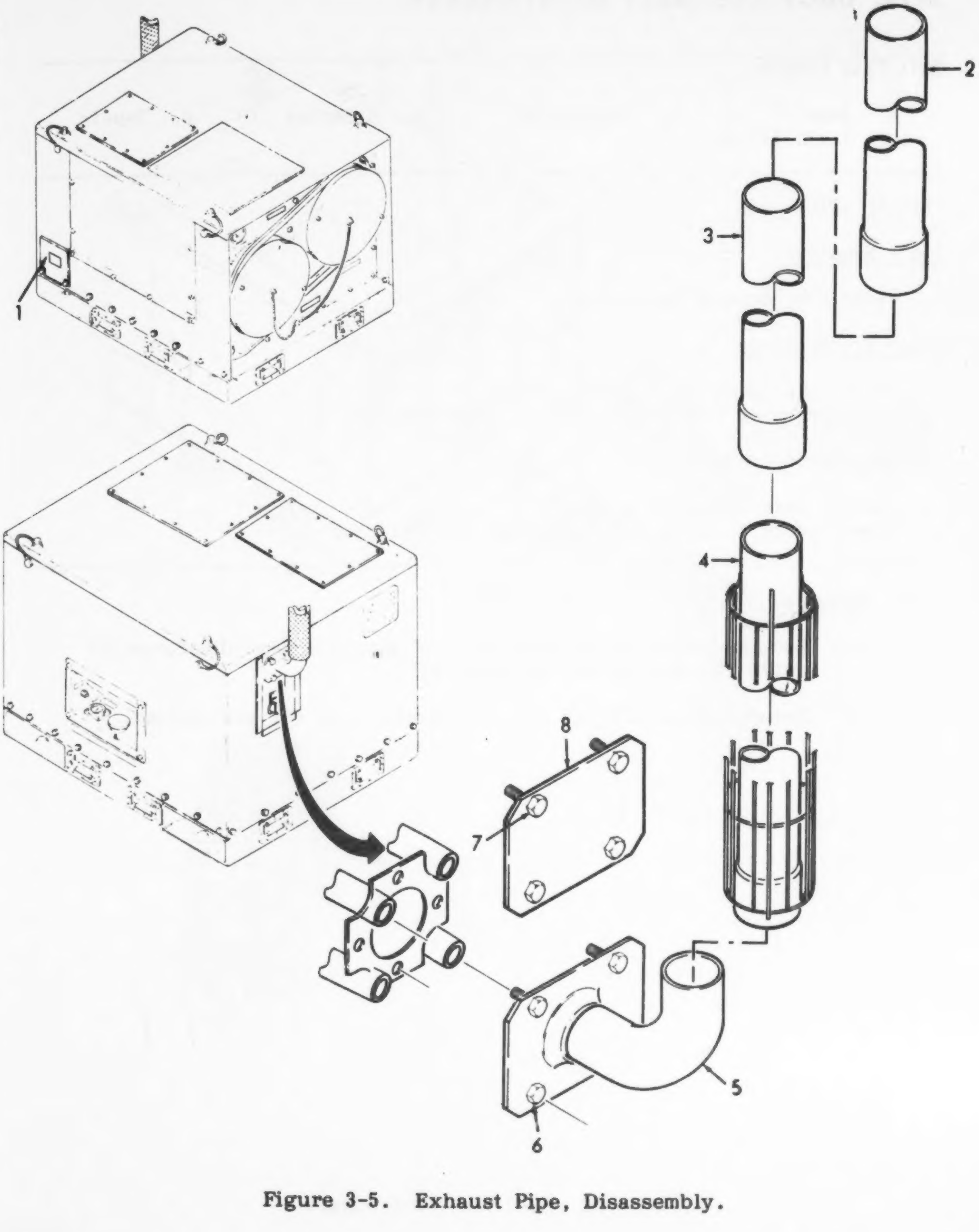

Figure 3-5. Exhaust Pipe, Disassembly.

3-12. DUCT ASSEMBLY MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Repair
e. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Mild Soap (Item 10, Appendix E)
Pressure Sensitive Tape (Item 13, Appendix E)

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.

---

a. **Removal**.

(1) Loosen clamps (3) on duct (2) and duct (1) from discharge air outlet (5) and return air inlet (4)..

(2) Remove ducts (2) and (1) from heater unit (6) and shelter.

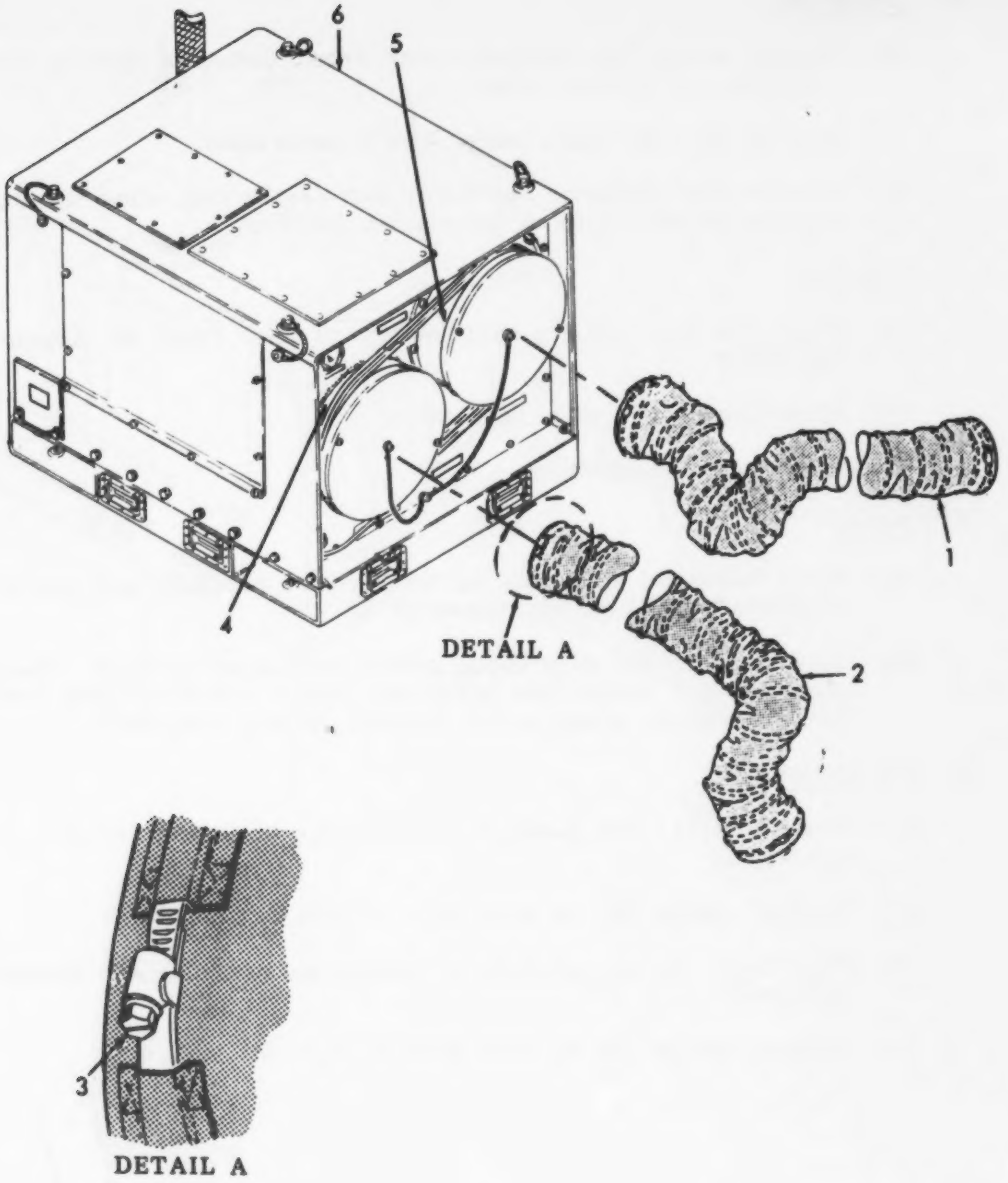
6
5
1
4
DETAIL A
2
3
DETAIL A

Figure 3-6. Air Duct, Removal.

3-12. DUCT ASSEMBLY MAINTENANCE - Continued.

b. Inspection.

(1) Inspect clamps for damaged screw head, deformed slots on strap, corrosion, or broken strap.

(2) Inspect duct for rips, tears, and deterioration.

(3) Inspect duct stiffener for bends and breaks that allow the duct to collapse or have torn or punctured the duct.

c. Cleaning.

(1) Clean the duct using a mild solution of soap (item 10, Appendix E) and water.

(2) Rinse thoroughly with clean water.

(3) Allow to dry completely.

d. Repair.

(1) Small tears and holes may be repaired by patching with pressure sensitive tape (item 13, Appendix E).

(2) Replace clamp by unscrewing screw until strap is loose. Remove clamp strap. Insert new strap into duct. Connect clamp connector and tighten screw a few turns to secure strap end.

e. Installation.

(1) Place duct (1) into position on discharge air outlet (5) and shelter connector.

(2) Tighten clamps (3) on both ends of duct (1) securely.

(3) Place duct (2) into position on return air duct (4) and shelter connector.

(4) Tighten clamps (3) on both ends of duct (2) securely.

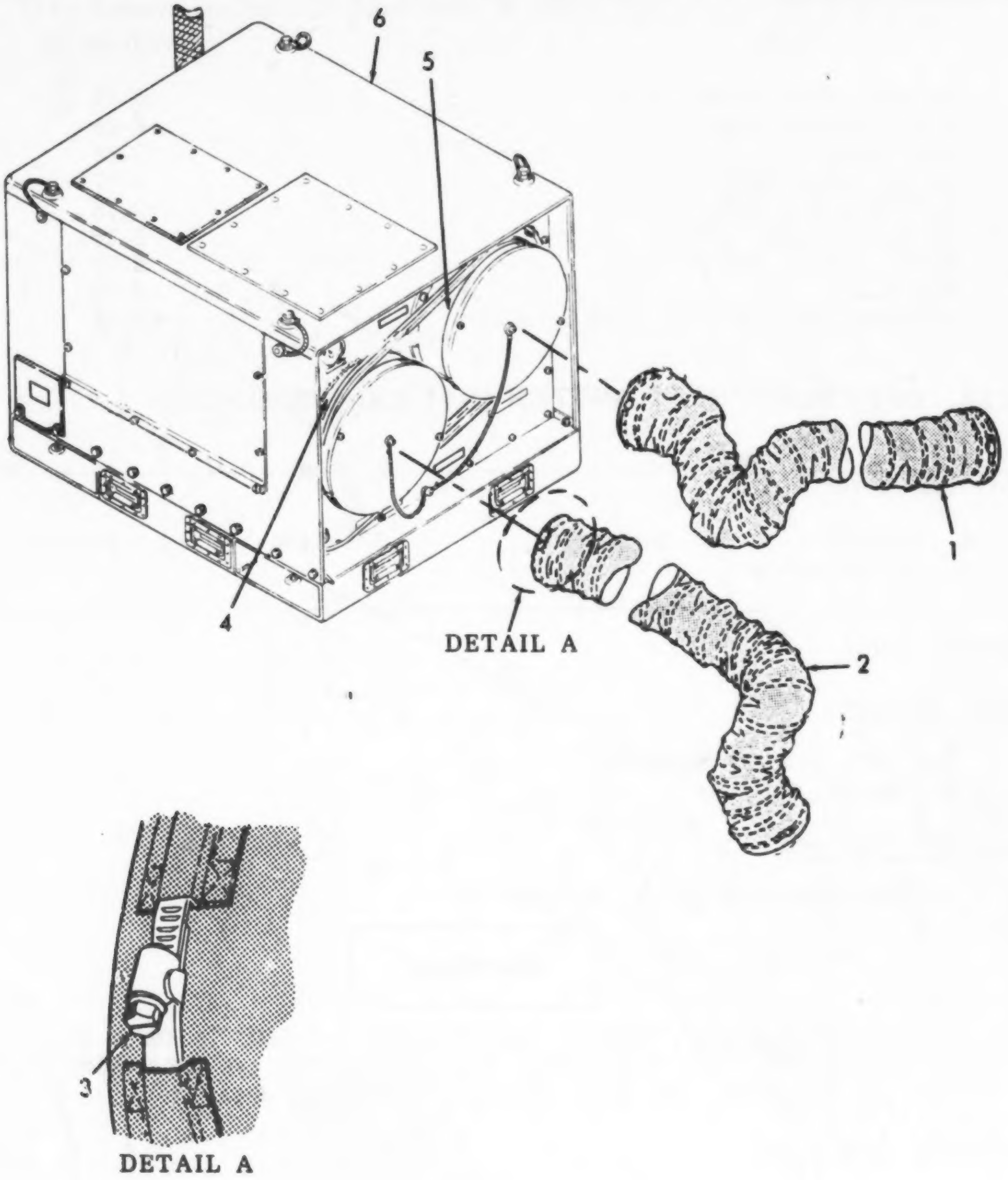
6
5
1
4
DETAIL A
2
3
DETAIL A

Figure 3-7. Air Duct, Installation.

3-13. CONTROL PANEL MAINTENANCE.

Maintenance of the control panel is limited to the repair of the panel by replacement of components at the unit level. These items are covered as follows:

Item	Paragraph No.
OFF/VENT/HEAT Switch (S1)	3-14
Fuel Pressure Gage	3-15
Hour Meter	3-16
Safety Relay (K8)	3-17
Audible Alarm (EM1)	3-18
Circuit Breaker (CB1)	3-19
ON/OFF Toggle Switch (S7)	3-20
Rectifier	3-21
INTERNAL TANK/EXTERNAL TANK Selector	3-22

3-14. OFF/VENT/HEAT SWITCH (S1) MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Testing
e. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics
Multimeter

Materials Required:

Trichloroethane (Item 14, Appendix E)

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door removed (para 3-10a).

---

a. Removal.

(1) Tag and disconnect all leads from rear of switch (5).

(2) Remove screw (2) and knob (1).

(3) Remove four screws (3) from front of panel (4).

(4) Remove switch (5) from rear of panel (4).

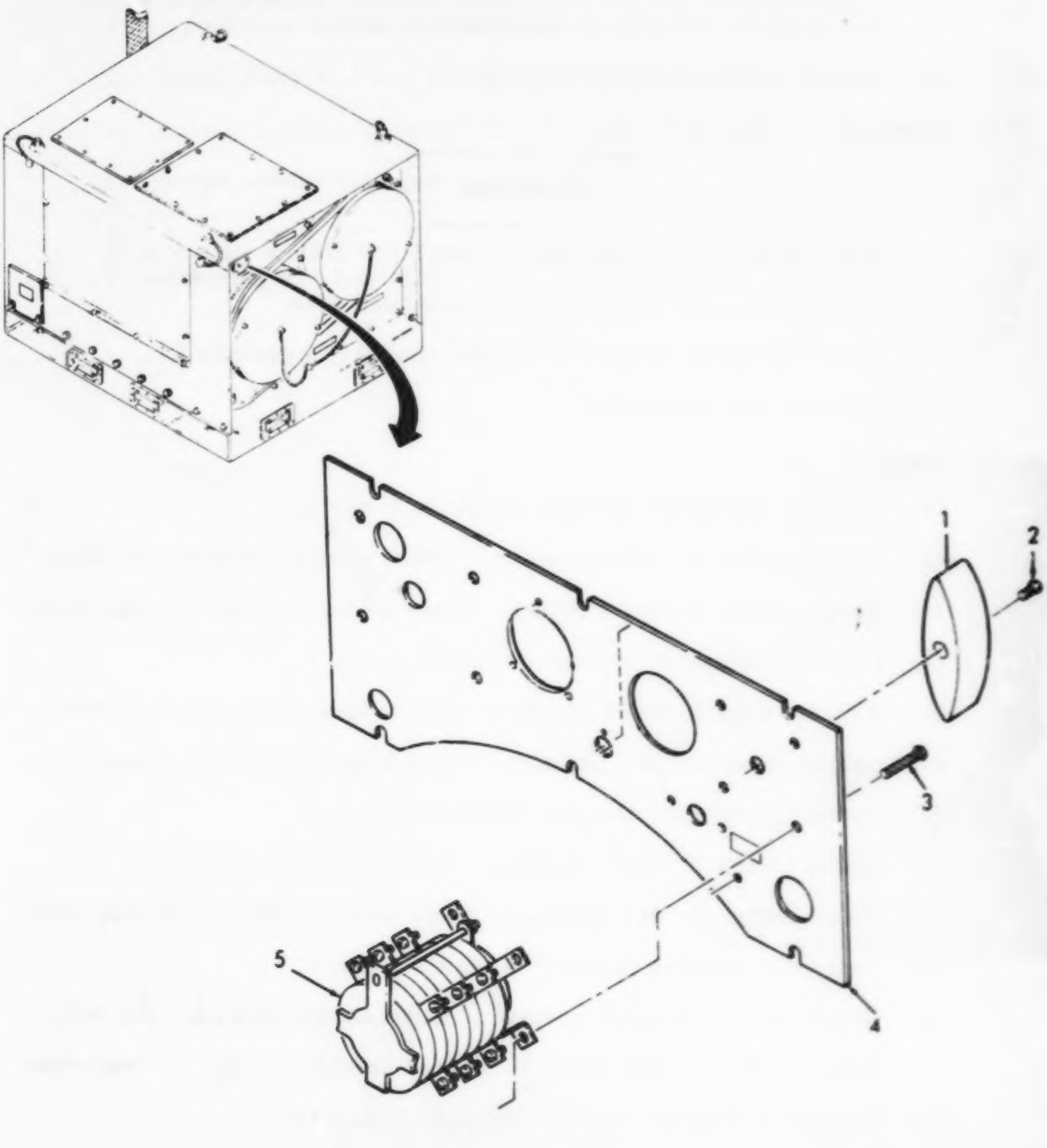

Figure 3-8. OFF/VENT/HEAT Switch (S1), Removal.

3-14. OFF/VENT/HEAT SWITCH (S1) MAINTENANCE - Continued.

b. Inspection.

(1) Inspect switch for broken or burned terminals.

(2) Inspect switch for bent or broken switch. Be sure that switch has positive action in all positions.

(3) Inspect switch housing for cracks.

c. Cleaning.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(1) Wash the switch in trichloroethane (item 14, Appendix E).

(2) Allow to dry completely.

d. Testing.

(1) Connect multimeter between terminals 1 and 2.

(2) Rotate switch to VENT position. Meter should indicate < 10 ohms.

(3) Rotate switch to OFF position. Meter should indicate > 1 Meg-ohms.

(4) Connect multimeter between terminals 1 and 3.

(5) Rotate switch to HEAT position. Meter should indicate < 10 ohms.

(6) Rotate switch to OFF position. Meter should indicate > 1 Meg-ohms.

(7) Connect multimeter between terminals 5 and 6.

(8) Rotate switch to VENT position. Meter should indicate < 10 ohms.

(9) Rotate switch to OFF position. Meter should indicate > 1 Meg-ohms.

(10) Connect multimeter between terminals 5 and 7.

(11) Rotate switch to HEAT position. Meter should indicate < 10 ohms.

(12) Rotate switch to OFF position. Meter should indicate > 1 Meg-ohms.

(13) Connect multimeter between terminals 9 and 11.

(14) Rotate switch to HEAT position. Meter should indicate < 10 ohms.

(15) Rotate switch to OFF and then VENT positions. Meter should indicate > 1 Meg-ohms.

e. Installation.

(1) Install switch (5) to rear of panel (4).

(2) Install four screws (3) to secure switch (5).

(3) Install knob (1) and secure with screw (2).

(4) Connect wiring to switch (5) per tagged identification.

(5) Install access door per para 3-10d.

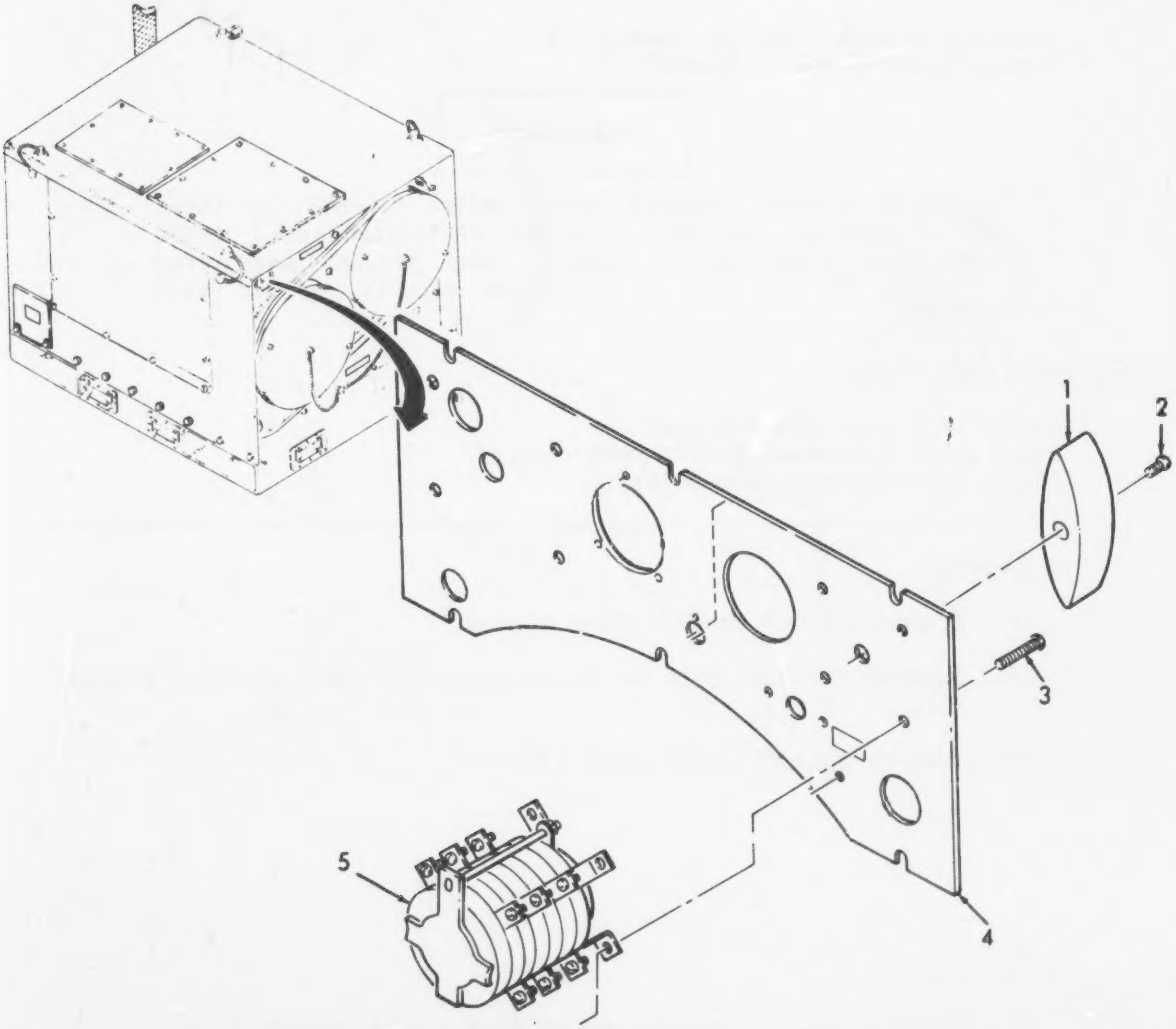

Figure 3-9. OFF/VENT/HEAT Switch (S1), Installation.

3-15. FUEL PRESSURE GAGE MAINTENANCE.

This Task Covers:

a. Removal b. Cleaning c. Inspection d. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Cleaning Solvent (Item 11, Appendix E)
Glass Cleaner (Item 3, Appendix E)

WARNING

Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door removed (para 3-10a).

a. Removal.

(1) Disconnect fuel line (6) from gage (1).

(2) Remove two nuts (5), two lockwashers (4), and mounting bracket (3).

(3) Remove gage (1) from panel (2).

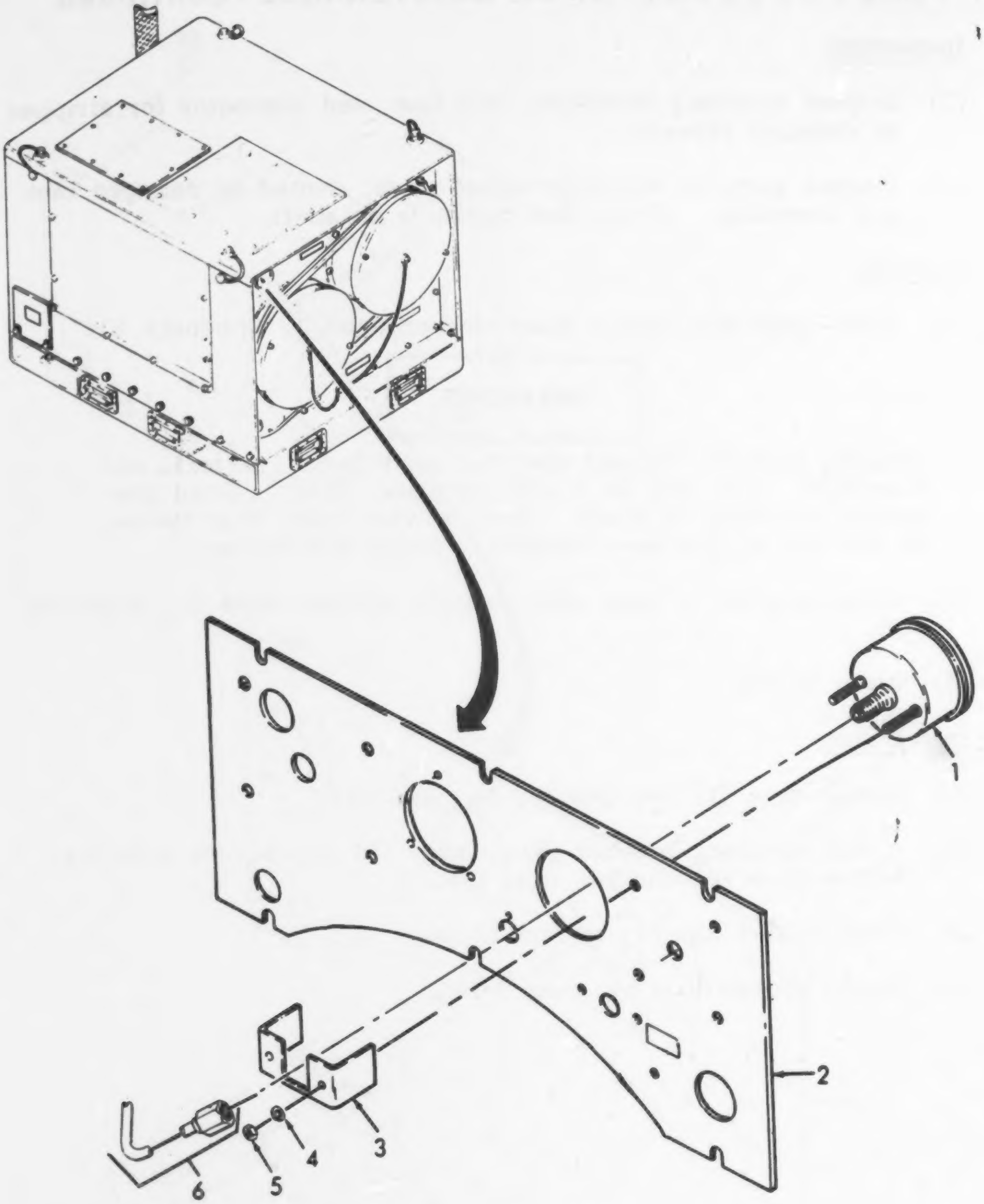

Figure 3-10. Fuel Pressure Gage, Removal.

3-15. FUEL PRESSURE GAGE MAINTENANCE -Continued.

b. Inspection.

(1) Inspect mounting hardware, fuel line, and connector for stripped or damaged threads.

(2) Inspect gage for broken/cracked glass, dented or damaged case and corrosion. Check that needle is on shaft.

c. Cleaning.

(1) Clean gage face with a glass cleaner (item 3, Appendix E).

WARNING

Cleaning solvent, Federal specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

(2) Clean exterior of gage with cleaning solvent (item 11, Appendix E).

(3) Allow to dry.

d. Installation.

(1) Install gage (1) into position in panel (2).

(2) Install mounting bracket (3) to gage (1) and secure with two lockwashers (4) and two nuts (5).

(3) Connect fuel line (6) to rear of gage (1).

(4) Install access door per para 3-10d.

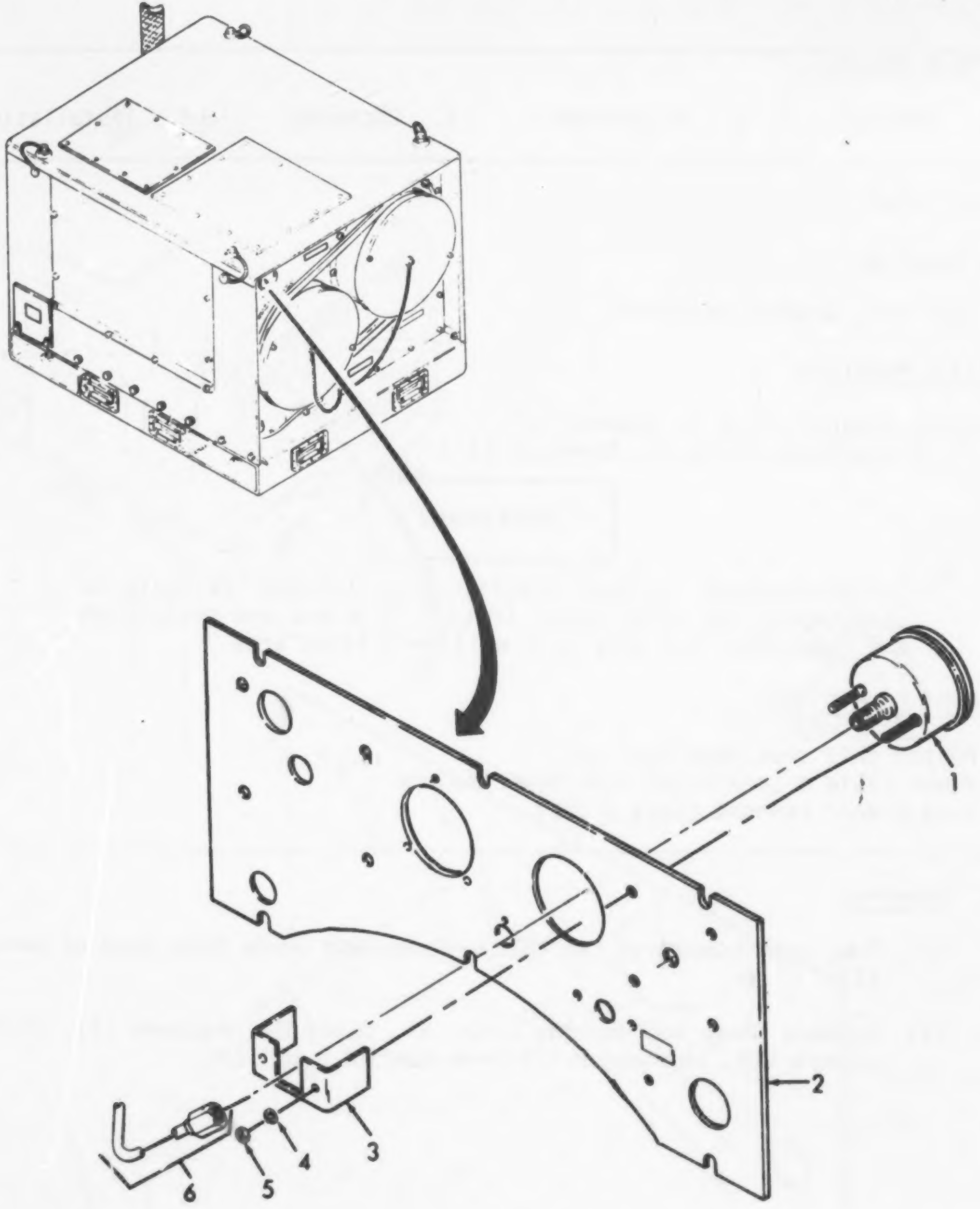

Figure 3-11. Fuel Pressure Gage, Installation.

3-16. HOUR METER MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Glass Cleaner (Item 3, Appendix E)
Trichloroethane (Item 14, Appendix E)

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door removed (para 3-10a).

a. Removal.

(1) Tag and disconnect two quick-disconnect leads from rear of meter (2).

(2) Remove three self-locking nuts (5), three flat washers (4), three screws (1), and meter (2) from control panel (3).

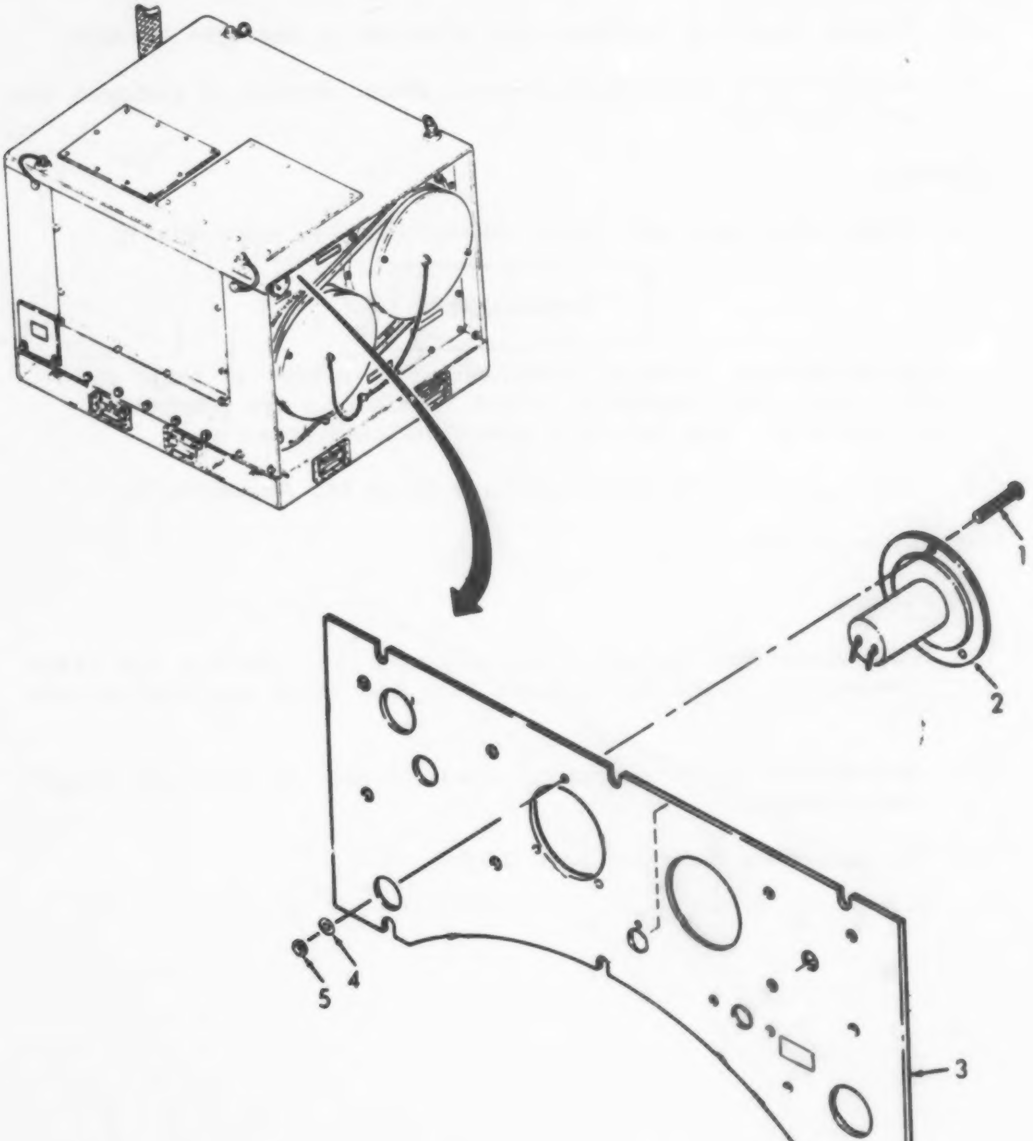

Figure 3-12. Hour Meter, Removal.

3-16. HOUR METER MAINTENANCE - Continued.

b. Inspection.

(1) Inspect mounting hardware for stripped or damaged threads.

(2) Inspect meter for broken/cracked glass, dented or damaged case, and corrosion.

c. Cleaning.

(1) Clean meter face with glass cleaner (item 3, Appendix E).

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(2) Wash the meter in trichloroethane (item 14, Appendix E).

(3) Allow to dry.

d. Installation.

(1) Place meter (2) through front of panel (3). Secure with three screws (1), three flat washers (4), and three self-locking nuts (5).

(2) Connect two quick-disconnect leads to rear of meter per tagged identification.

(3) Install access door per para 3-10d.

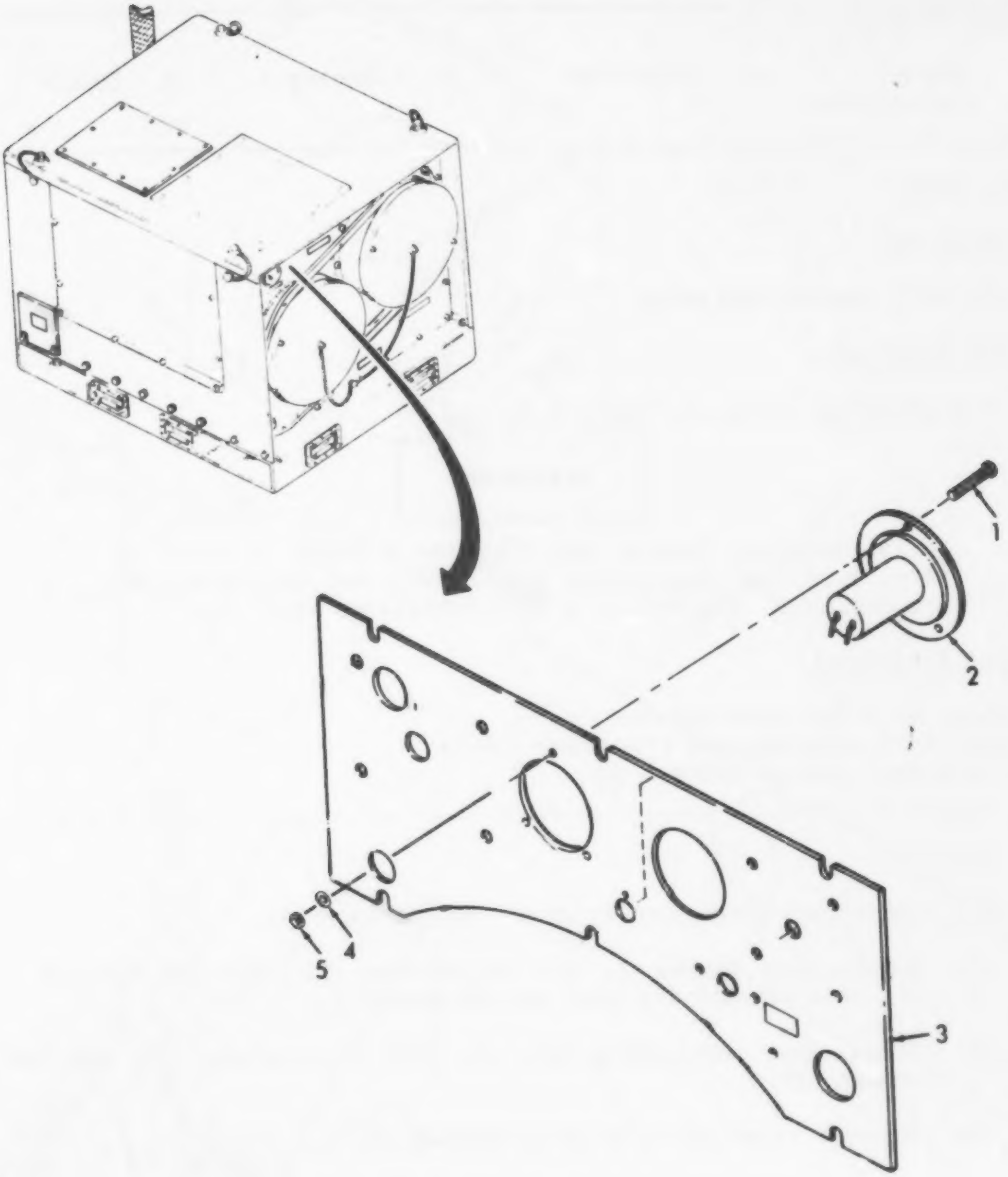

Figure 3-13. Hour Meter, Installation.

3-17. COMBUSTION CONTROL RELAY (K8) MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Repair
e. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Trichloroethane (Item 14, Appendix E)

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door removed (para 3-10a).

---

a. **Removal.**

(1) Disconnect connector (6) from relay bracket (5).

(2) Remove four screws (1) four lockwashers (2), four flat washers (3), and bracket (5) from control panel (4).

(3) Remove four self-locking nuts (7), four flat washers (9), and four screws (10).

(4) Separate relay (8) from relay bracket (5).

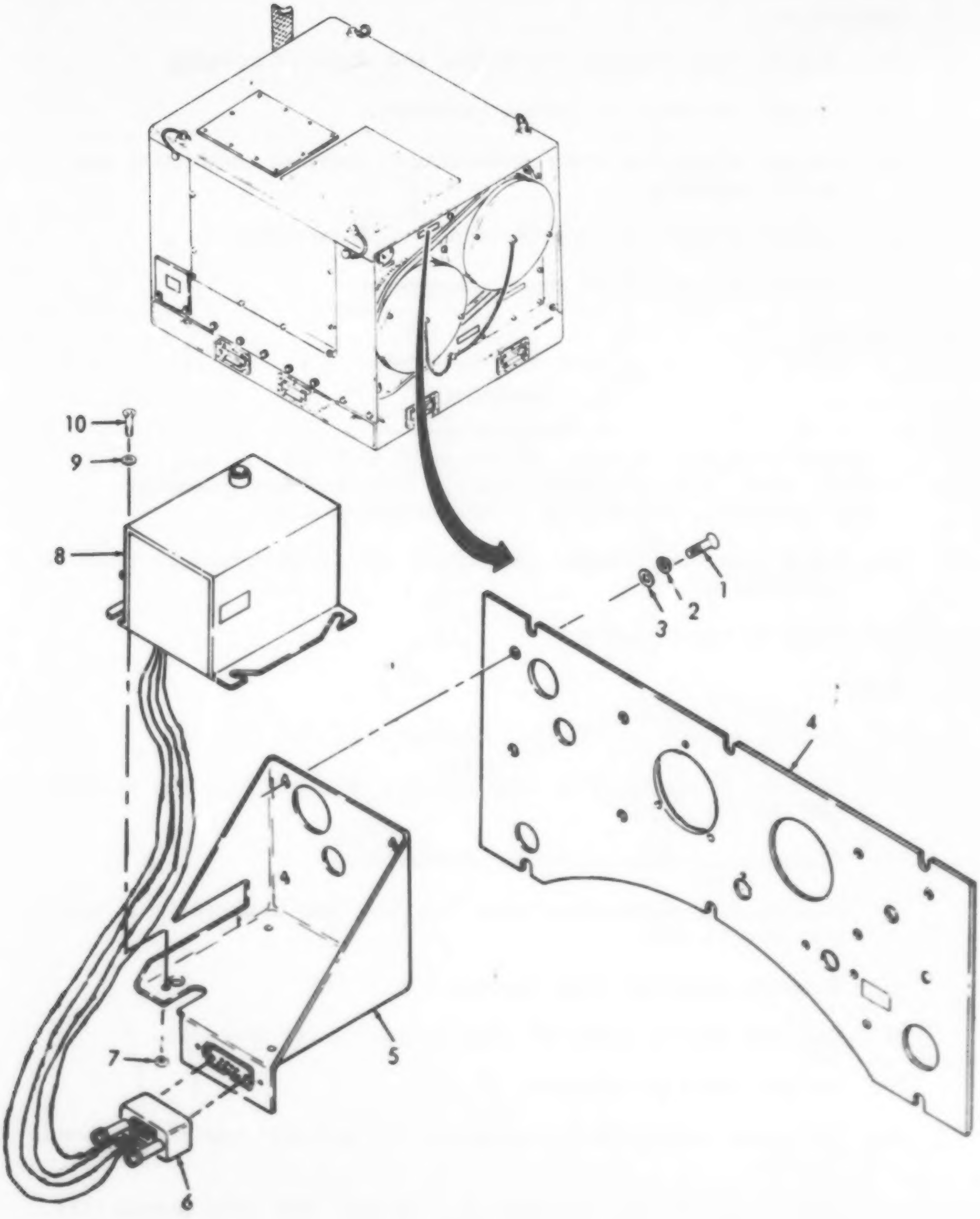
10
9
8
1
2
3
4
5
7
6

Figure 3-14. Combustion Control Relay K8, Removal.

3-17. COMBUSTION CONTROL RELAY (K8) MAINTENANCE - continued.

b. Inspection.

(1) Inspect relay housing for cracks and signs of burning.

(2) Inspect for loose or missing hardware.

(3) Inspect wiring for cracked insulation, exposed conductor, and secure mounting.

(4) Inspect bracket for cracks, dents, and corrosion.

(5) Inspect connector for loose connections.

c. Cleaning.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(1) Clean relay and bracket thoroughly with trichloroethane (item 14, Appendix E).

(2) Allow to dry completely.

d. Repair.

(1) Unplug connector (12) from bracket (1).

(2) Remove two screws (2), two locknuts (6), and four flat washers (3) and (5).

(3) Separate connector (4) from bracket (1).

(4) Remove four self-locking nuts (7), four flat washers (10), and four screws (11).

(5) Separate relay (9) from bracket (1).

(6) Tag and remove wires (8) from connector (4) and (12).

(7) Replace parts as required.

(8) Reconnect wiring (8) to connector (4) and (12) per tagged identification.

(9) Place relay (9) into bracket (1). Secure with four screws (11), four flat washers (10), and four self-locking nuts (7).

(10) Place connector (4) into position on bracket (1) and secure with four flat washers (3) and (5), two locknuts (6), and two screws (2).

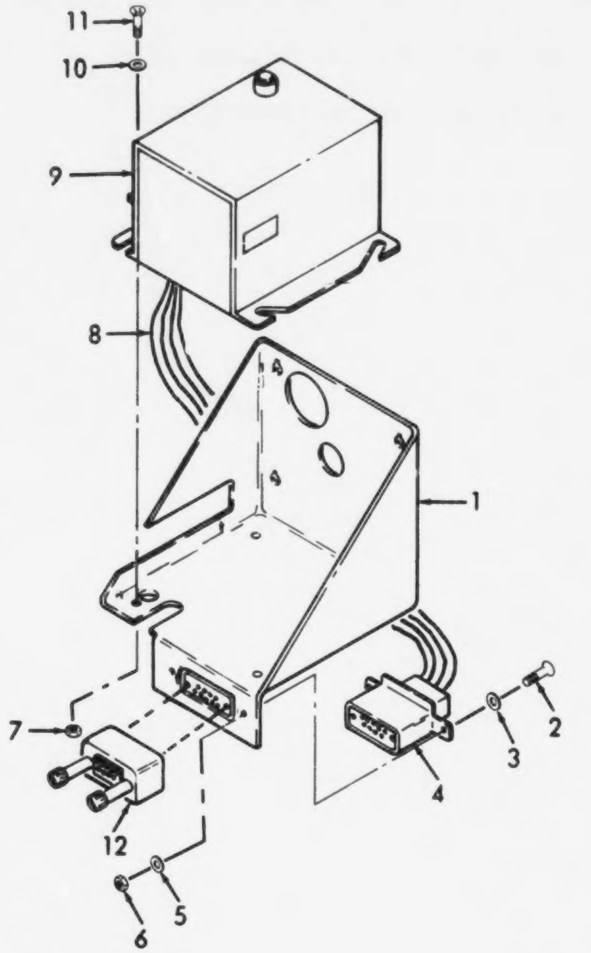

Figure 3-15. Combustion Control Relay K8, Repair.

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3-17. combustion control relay (K8) MAINTENANCE - Continued.

e. Installation.

(1) Install relay (8) and secure with four self-locking nuts (7), four flatwashers (9), and four screws (10) to bracket (5).

(2) Place relay bracket (5) into position and secure with four flat washers (3), four lockwashers (2), and four screws (1).

(3) Connect connector (6) to relay (5).

(4) Install access door per para 3-10d.

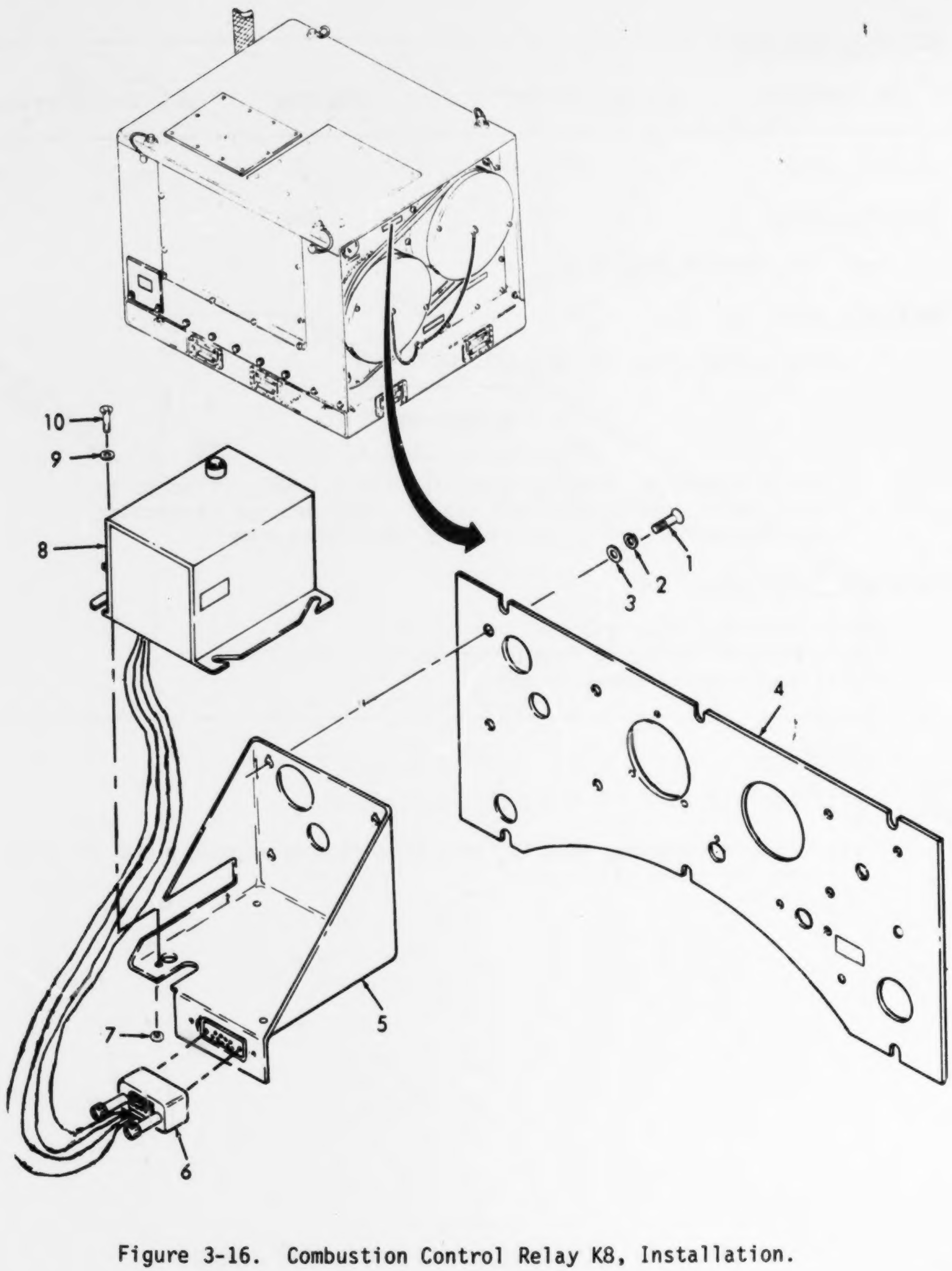

10
9
8
1
2
3
4
5
7
6

Figure 3-16. Combustion Control Relay K8, Installation.

3-18. AUDIBLE ALARM (EM1) MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Trichloroethane (Item 14, Appendix E)

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door removed (para 3-10a).

---

a. Removal.

(1) Tag and then cut wires (3) near splice.

(2) Remove retaining ring (1) and then remove audible alarm (2) from rear of panel (4).

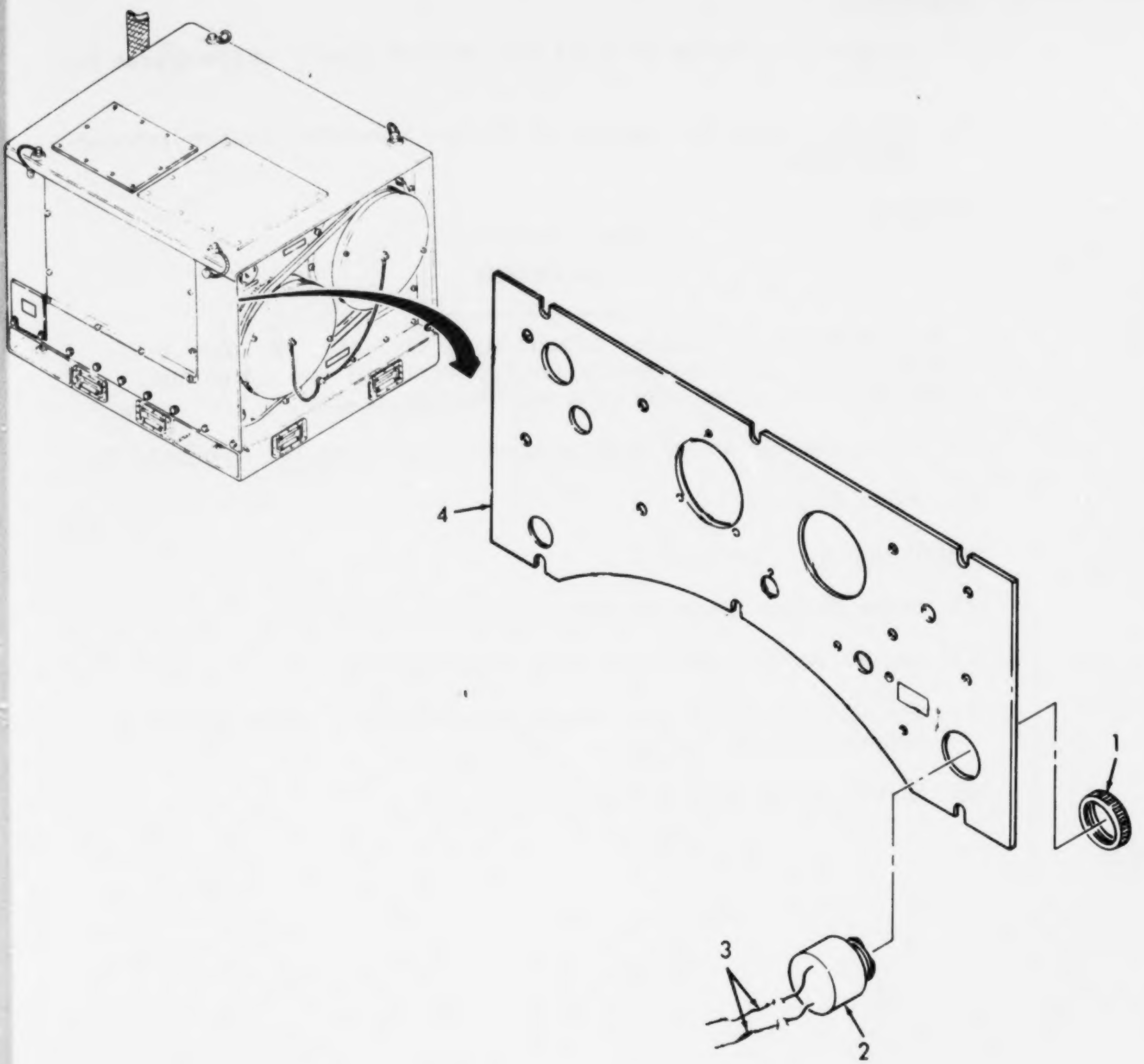


Figure 3-17. Audible Alarm (EM1), Removal.

3-18. AUDIBLE ALARM (EM1) MAINTENANCE - Continued.

b. Inspection.

(1) Inspect for damage to front and rear of alarm. Inspect case for cracks.

(2) Inspect wiring for cracked or burned insulation and/or exposed conductor.

c. Cleaning.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(1) Clean audible alarm with trichloroethane (item 14, Appendix E).

(2) Allow to dry.

d. Installation.

(1) Place audible alarm (2) into position in panel (4).

(2) Secure audible alarm (2) with retaining ring (1).

(3) Connect wiring (3) per tagged identification, using splices to connect wiring.

(4) Install access door per para 3-10d.

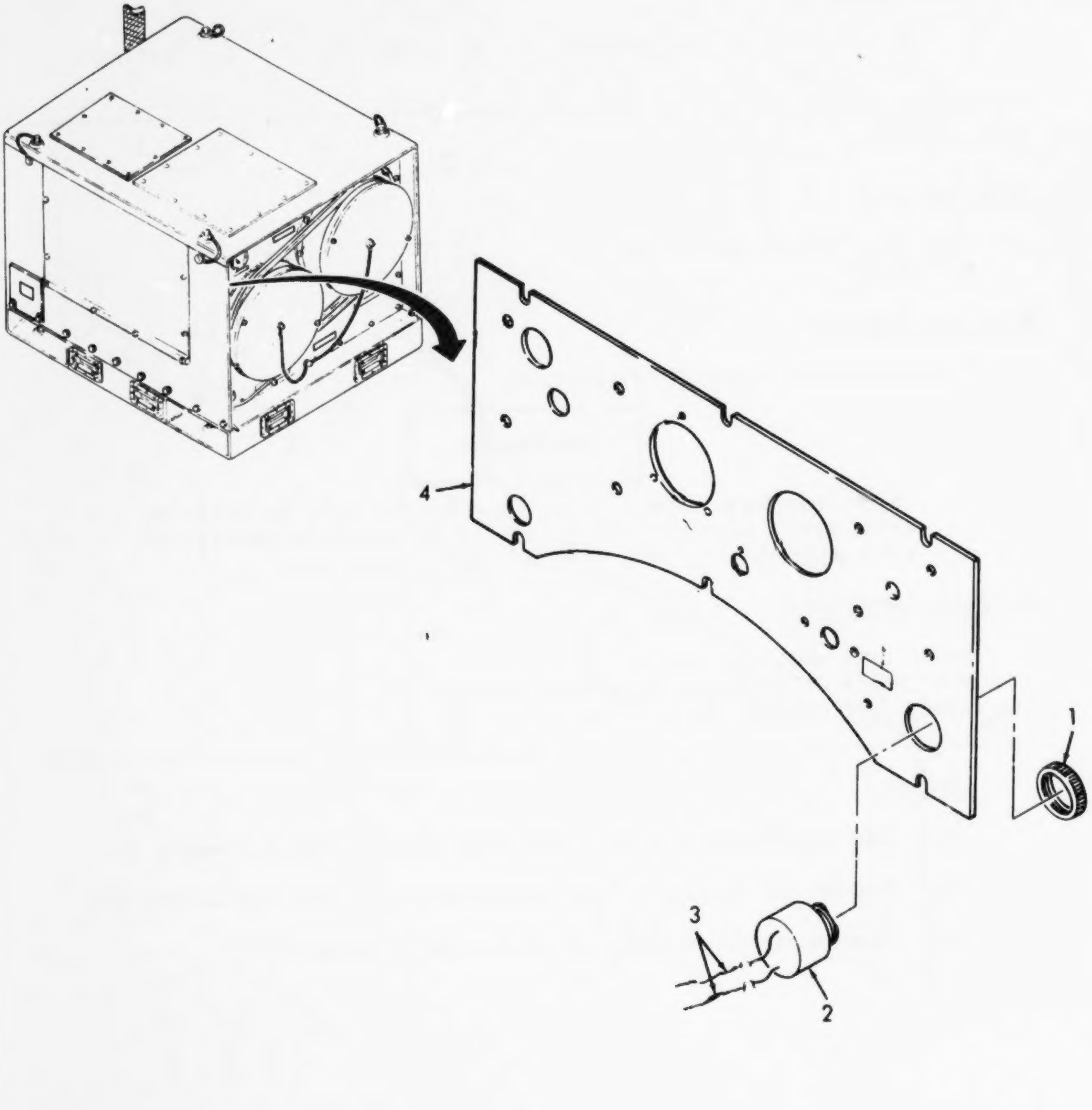


Figure 3-18. Audible Alarm (EM1), Installation.

3-19. CIRCUIT BREAKER (CB1) MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Testing
e. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics
Multimeter

Materials Required:

Trichloroethane (Item 14, Appendix E)

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door removed (para 3-10a).

---

a. Removal.

(1) Tag and disconnect two wires from rear of circuit breaker (3).

(2) Remove two nuts (5), two lockwashers (4), and two screws (2).

(3) Remove circuit breaker (3) from control panel (1).

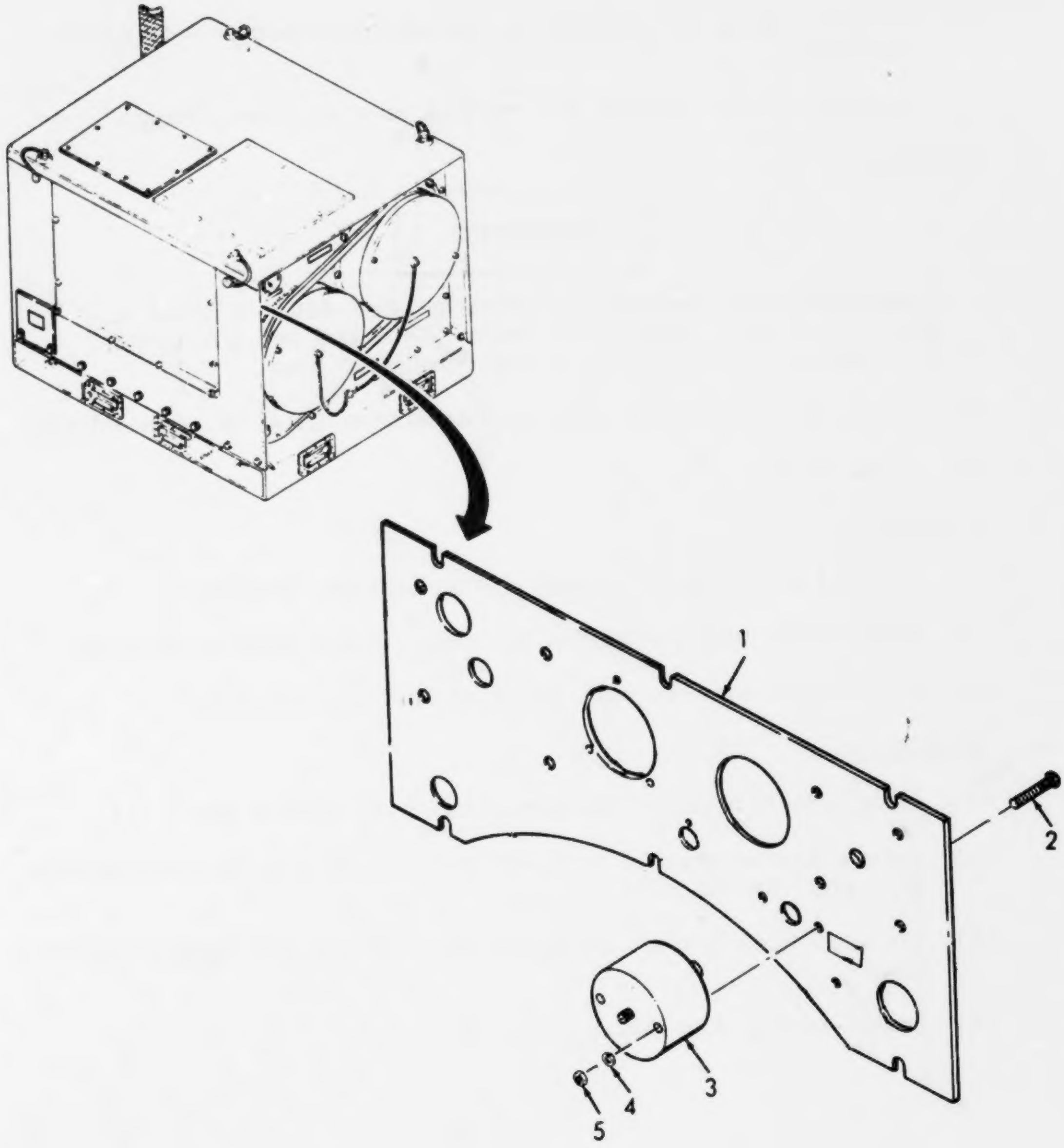


Figure 3-19. Circuit Breaker (CB1), Removal.

3-19. CIRCUIT BREAKER (CB1) MAINTENANCE - Continued.

b. Inspection.

(1) Inspect wiring for cracked or burned insulation and/or exposed conductor.

(2) Inspect circuit breaker for cracked case or other damage.

c. Cleaning.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(1) Clean circuit breaker with trichloroethane (item 14, Appendix E).

(2) Allow to dry.

d. Testing.

(1) Connect a multimeter across circuit breaker terminals.

(2) With circuit breaker button in, meter should indicate 0 ohms.

(3) With circuit breaker out, meter should indicate infinity.

e. Installation.

(1) Place circuit breaker (3) into position on control panel (1).

(2) Secure circuit breaker (3) with two screws (2), two lockwashers (4), and two nuts (5).

(3) Connect wires to rear of circuit breaker (3) per tagged identification.

(4) Install access door per para 3-10d.

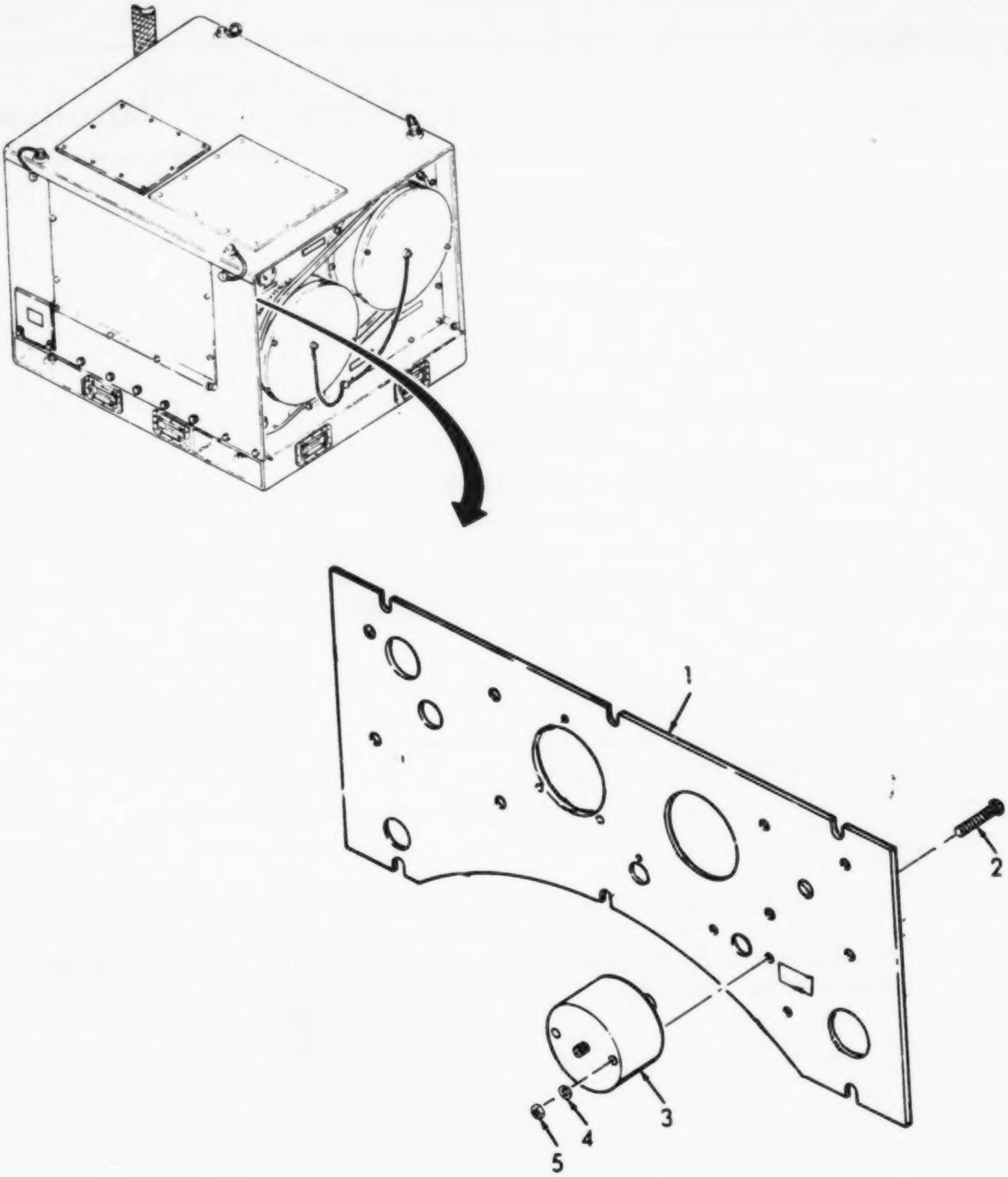


Figure 3-20. Circuit Breaker (CB1), Installation.

3-20. ON/OFF TOGGLE SWITCH MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Trichloroethane (Item 14, Appendix E)

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door removed (para 3-10a).

---

a. Removal.

(1) Tag and disconnect two wires from rear of switch (5).

(2) Remove nut (2), lockwasher (1), lock ring (4), and switch (5) from control panel (3).

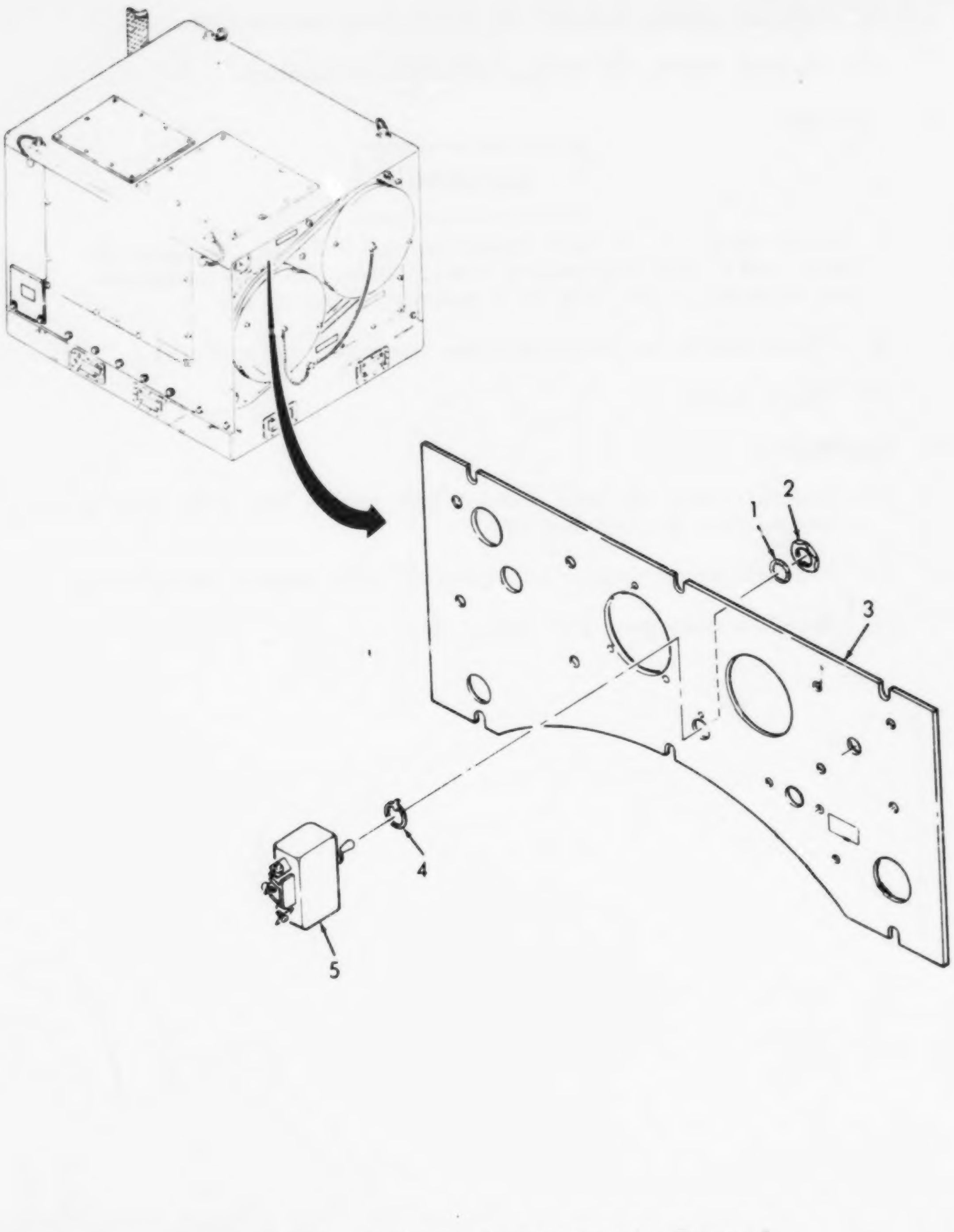


Figure 3-21. ON/OFF Toggle Switch, Removal.

3-20. ON/OFF TOGGLE SWITCH MAINTENANCE - Continued.

b. Inspection.

(1) Inspect switch and nut for stripped or damaged threads.

(2) Inspect switch for cracks and obvious damage.

c. Cleaning.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(1) Clean switch in trichloroethane (item 14, Appendix E).

(2) Allow to dry.

d. Installation.

(1) Install switch (5) into position and secure with lock ring (4), lockwasher (1) and nut (2).

(2) Connect wires to rear of switch (5) per tagged identification.

(3) Install access door per para 3-10d.

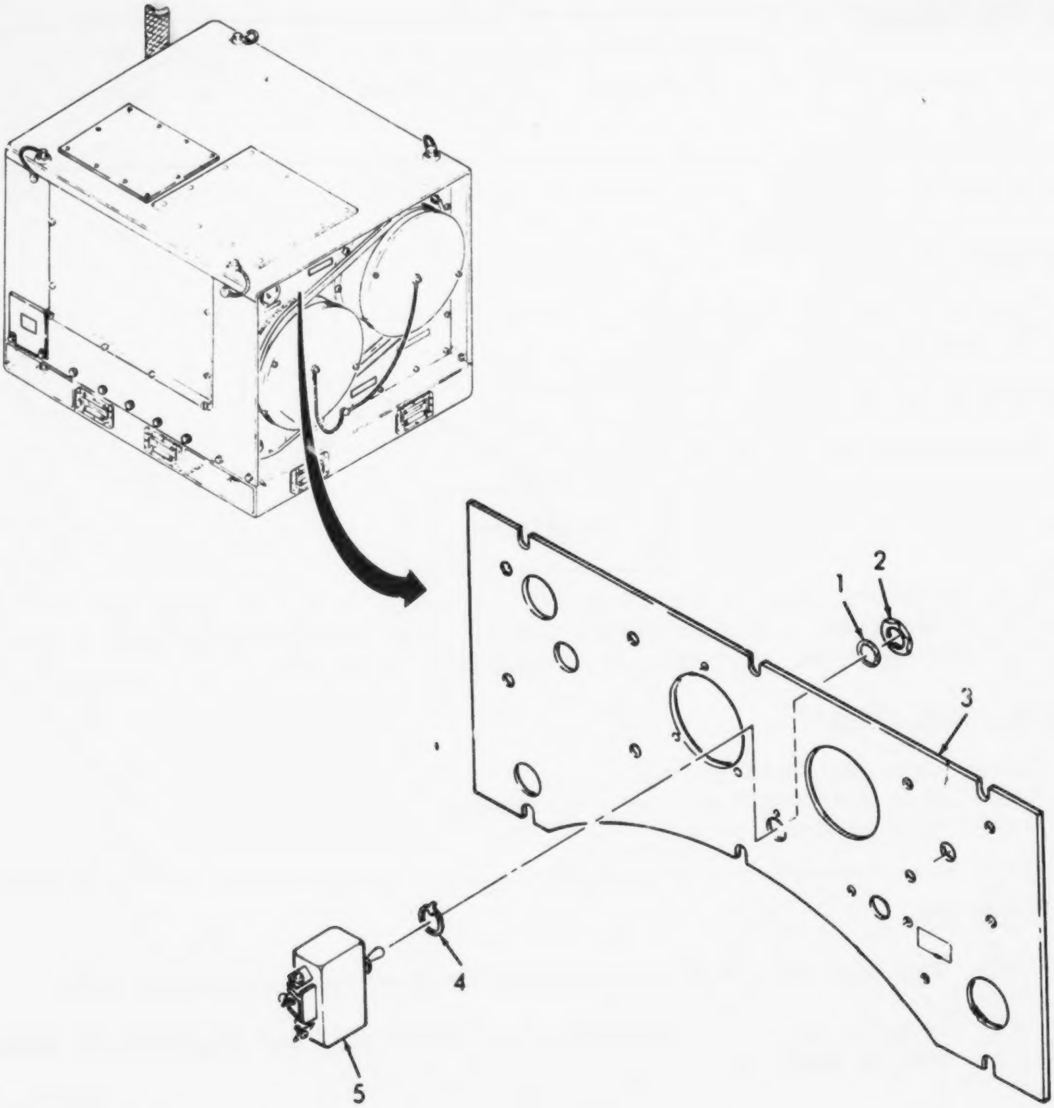


Figure 3-22. ON/OFF Toggle Switch, Installation.

3-21. RECTIFIER MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Testing
e. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics
Multimeter

Materials Required:

Trichloroethane (Item 14, Appendix E)

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door removed (para 3-10a).

---

a. Removal.

(1) Tag and disconnect four connectors from rear of rectifier (4).

(2) Remove nut (5), lockwasher (3), screw (2), and rectifier (4) from control panel (1).

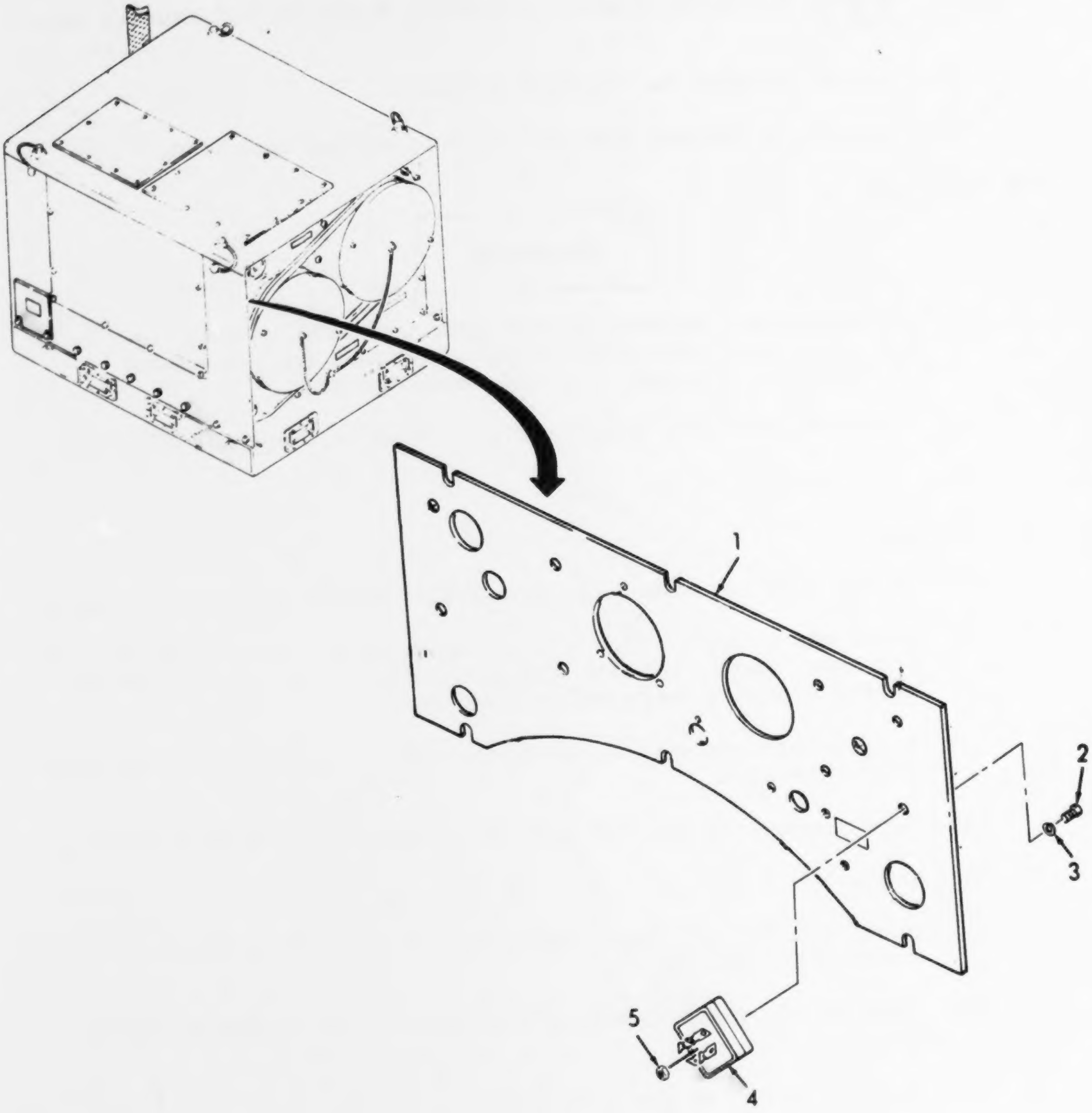


Figure 3-23. Rectifier, Removal.

3-21. RECTIFIER MAINTENANCE - Continued.

b. Inspection.

(1) Inspect wiring for cracked or burned insulation and exposed conductor.

(2) Inspect rectifier for damaged terminals.

(3) Inspect for cracked case and bubbled potting compound.

c. Cleaning.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(1) Clean rectifier with trichloroethane (item 14, Appendix E).

(2) Allow to dry.

d. Testing.

(1) Choose any two adjacent terminals and connect multimeter to them.

(2) Meter will indicate either a short or an open. Reverse meter leads and meter should indicate opposite. Example: if meter indicated short, reversing leads will indicate an open.

(3) Keep meter connected to one of the terminals and move other lead to next terminal.

(4) Repeat steps (2) and (3) until all terminals have been checked.

e. Installation.

(1) Install rectifier (4) into position and secure with screw (2), lockwasher (3), and nut (5).

(2) Connect four leads to rear of rectifier (4) per tagged identification.

(3) Install access door per para 3-10d.

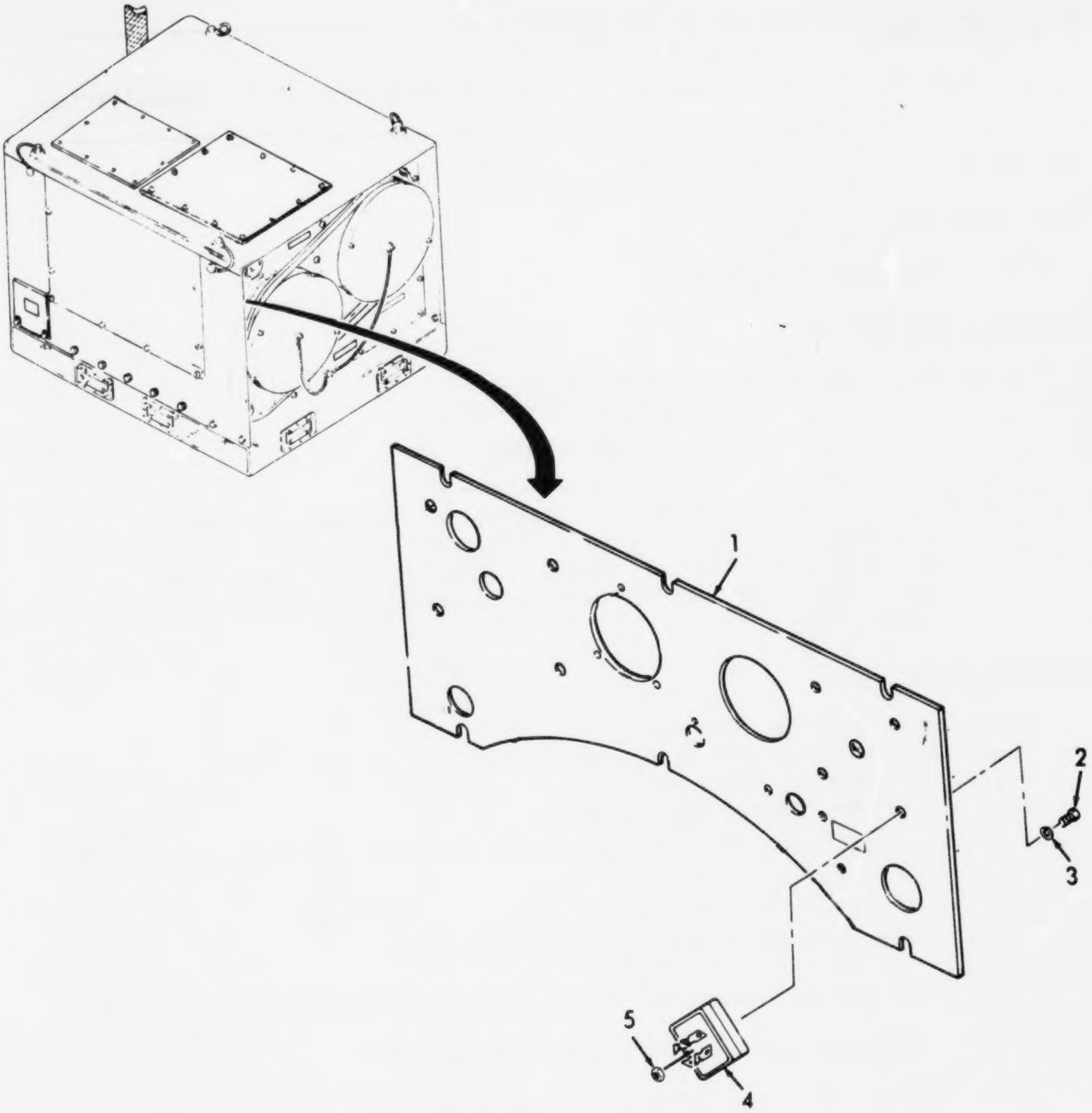


Figure 3-24. Rectifier, Installation.

3-22. INTERNAL TANK/EXTERNAL TANK SELECTOR MAINTENANCE.

This Task Covers:

a. Removal b. Cleaning c. Inspection d. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Cleaning Solvent (Item 11, Appendix E)

WARNING

Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door removed (para 3-10a).
Fuel oil filter removed (para 3-35a).

a. **Removal.**

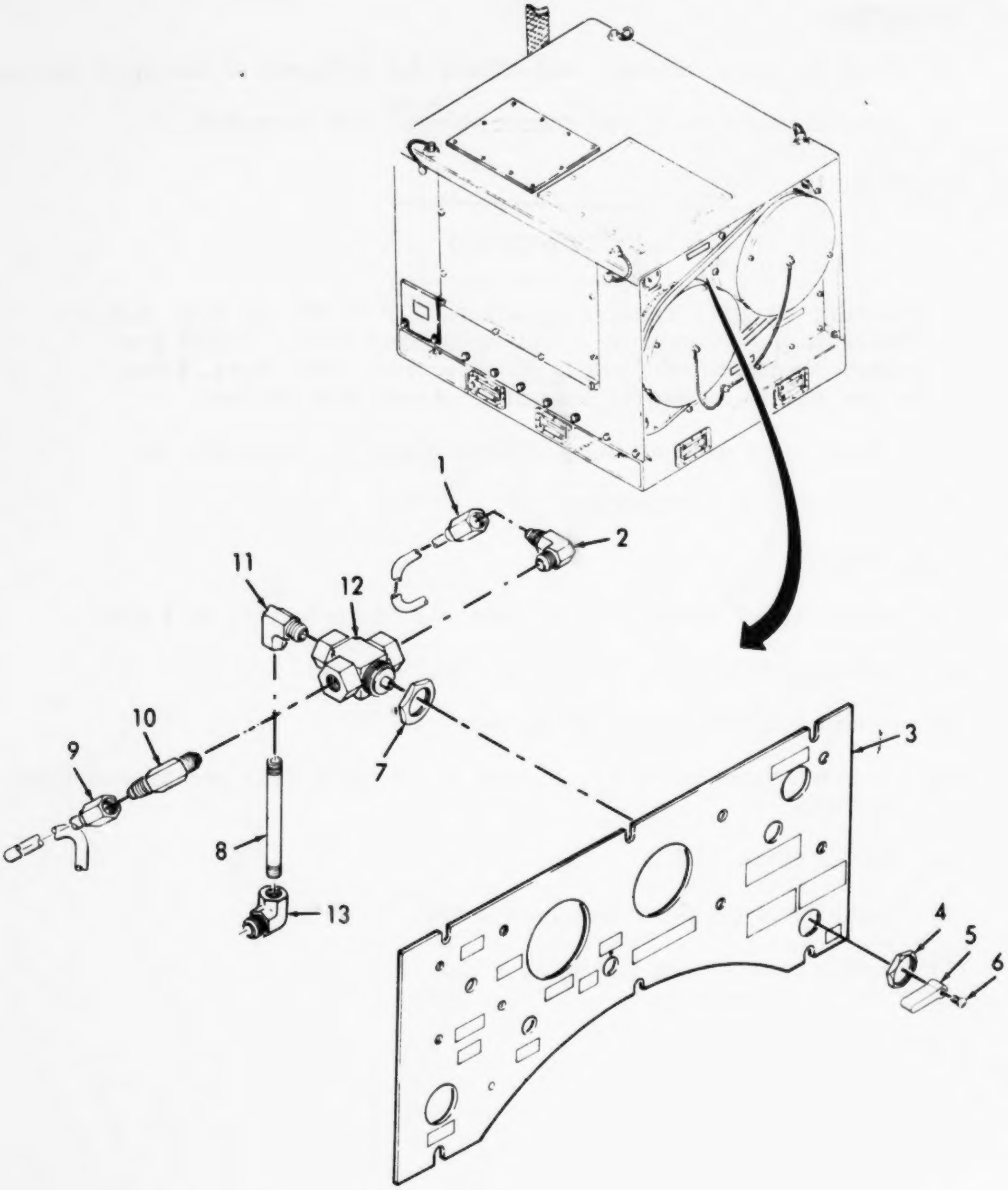
(1) Disconnect elbow (13) from fuel line (8).

(2) Tag and disconnect three fuel lines (1, 8, and 9) from valve (12).

(3) Loosen setscrew (6) and remove knob (5).

(4) Remove nut (4), valve (12), and locknut (7).

(5) Tag and remove three elbows (2, 10, and 11).


1
2
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9
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13
4
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6

Figure 3-25. INTERNAL TANK/EXTERNAL TANK Selector, Removal.

3-22. INTERNAL TANK/EXTERNAL TANK SELECTOR MAINTENANCE - Continued.

b. Inspection.

(1) Inspect valve, elbows, and tubing for stripped or damaged threads.

(2) Inspect valve body for cracks, holes, and corrosion.

c. Cleaning.

WARNING

Cleaning solvent, Federal specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

(1) Clean valve with cleaning solvent (item 11, Appendix E).

(2) Allow to dry completely.

d. Installation.

(1) Install three elbows (2, 10, and 11) to valve (12) and aline.

(2) Install locknut (7), valve (12), and nut (4).

(3) Install knob (5) and tighten setscrew (6).

(4) Connect three tubes (1, 8, and 9) to valve (12) per tagged identification.

(5) Install elbow (13).

(6) Install fuel oil filter per para 3-35e.

(7) Install access door per para 3-10d.

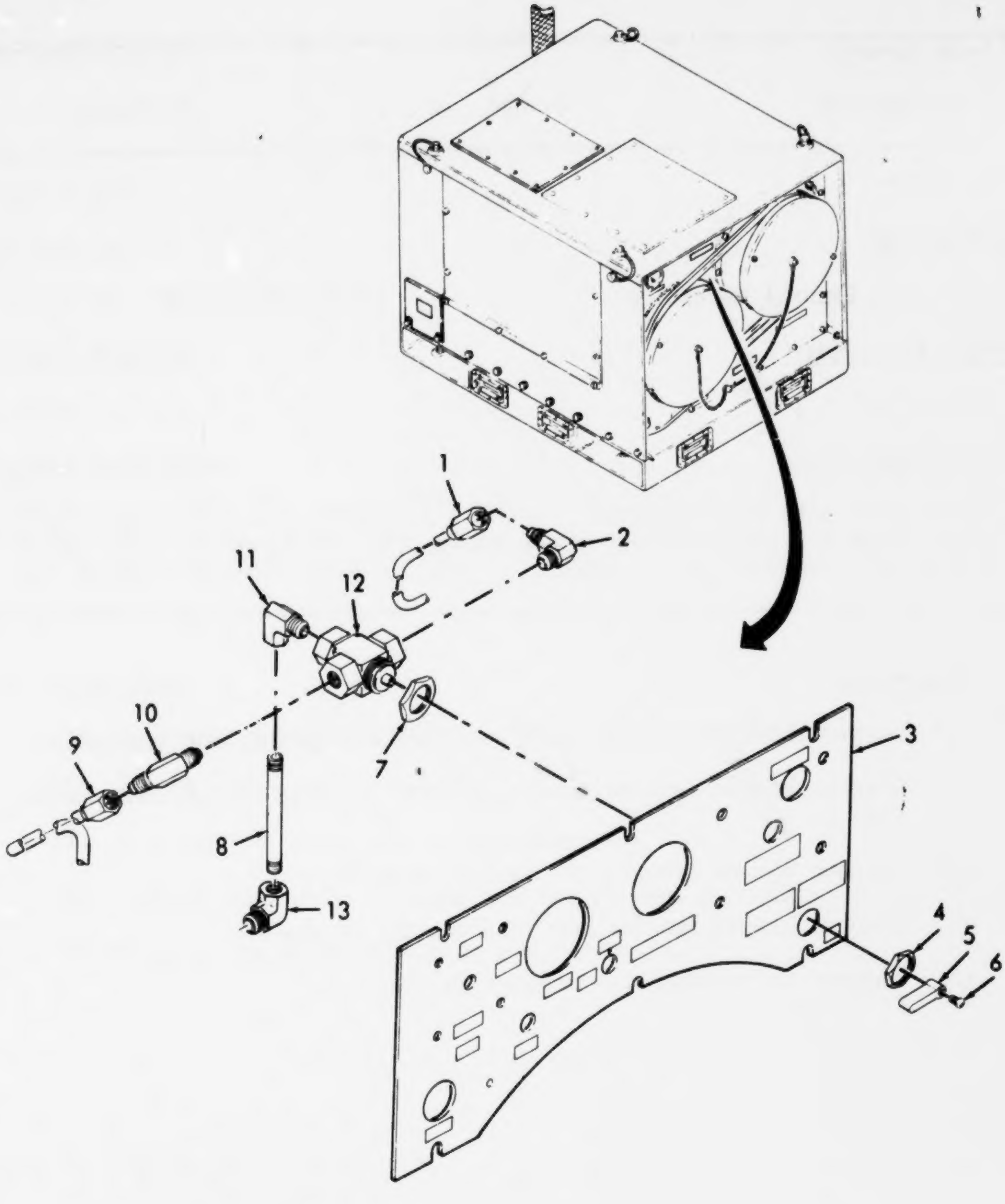
1
2
3
4
5
6
7
8
9
10
11
12
13

Figure 3-26. INTERNAL TANK/EXTERNAL TANK Selector, Installation.

3-23. BLOWER MAINTENANCE.

This Task Covers:

a. Inspection

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

None

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Air filters removed (para 3-10a).

---

a. Inspection.

(1) Inspect blower housing for holes, cracks, dents, and corrosion.

(2) Inspect blower fan for cracks, bends, missing blades, and corrosion.

(3) Inspect blower housing for secure mounting.

(4) Inspect blower fan for secure mounting to shaft.

(5) Inspect for missing or damaged hardware.

3-24. FUEL PUMP MAINTENANCE.

This Task Covers:

a. Inspection b. Adjust

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

None

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Air filters removed (para 3-10a).

a. Inspection.

(1) Inspect for loose, missing, or damaged hardware.

(2) Inspect fuel pump for leaks.

(3) Inspect fuel pump for secure mounting.

(4) Inspect fuel pump housing for cracks and corrosion.

(5) Inspect for missing or damaged hardware.

3-24. FUEL PUMP MAINTENANCE - Continued.

b. Adjust.

(1) Remove hex fitting (1) from side of fuel pump (3).

(2) Connect power cable to power source and operate unit per the instructions in Chapter 2, Section III.

(3) Use a screwdriver to adjust fuel pressure by rotating screw (2) to proper pressure (see Table 1-1).

(4) Shut down the heater unit and reinstall air filter and access door per instructions contained in paragraph 3-10d.

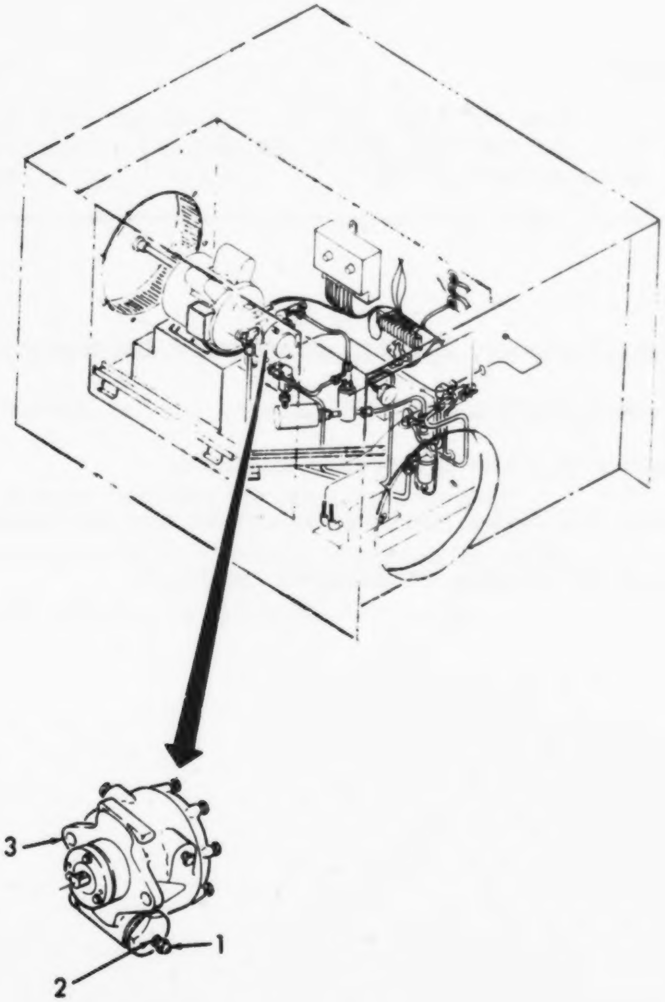

Figure 3-27. Fuel Pump, Servicing.

3-25. MOTOR MAINTENANCE.

This Task Covers:

a. Inspection

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

None

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Air filters removed (para 3-10a).

---

a. Inspection.

(1) Inspect motor shaft for bends, freedom of movement, and proper alinement.

(2) Inspect motor for secure mounting, missing, loose, or damaged hardware.

(3) Inspect motor wiring for cracked, burned, or damaged insulation and exposed conductors. Inspect wiring terminals for secure mounting and clean, tight connection.

(4) Inspect blower fan for secure mounting to shaft.

(5) Inspect for missing or damaged hardware.

3-26. TRANSFORMER MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Testing
e. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics
Multimeter

Materials Required:

Trichloroethane (Item 14, Appendix E)

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door removed (para 3-10a).

---

a. Removal.

(1) Tag and then remove wires from terminal 4 of TB1 (6) and terminal 6 of switch (S1).

(2) Tag and disconnect secondary leads from transformer connectors (5).

(3) Remove four screws (4), four lockwashers (8), four flat washers (7), and four nuts (9).

(4) Lift away transformer (6) with neoprene backing (2) from cabinet (3).

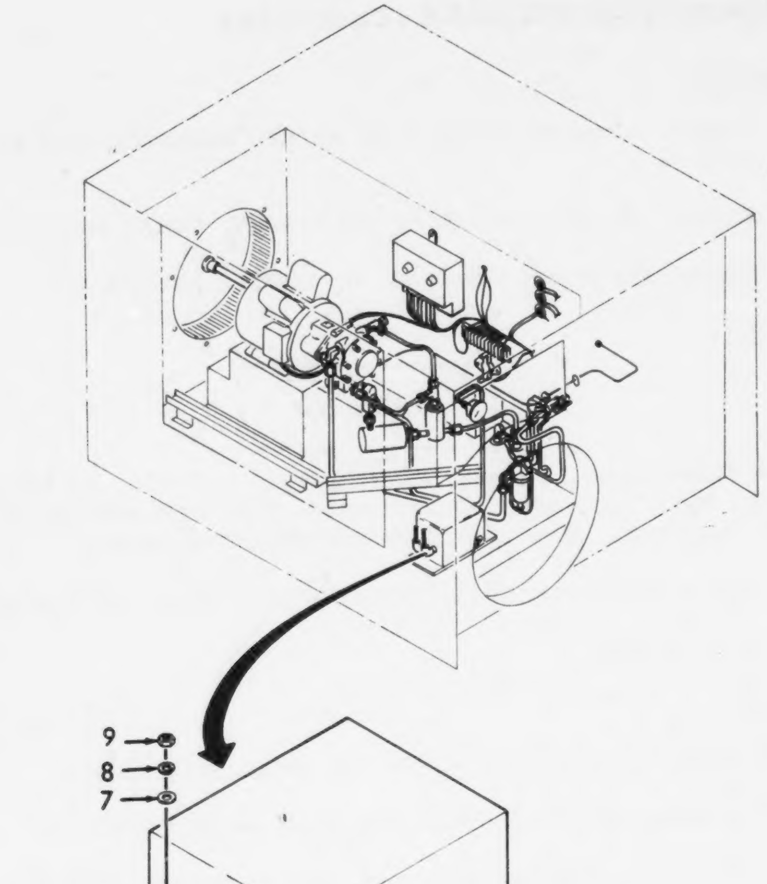

Figure 3-28. Transformer, Removal.

3-26. TRANSFORMER MAINTENANCE - Continued.

b. Inspection.

(1) Inspect wires for cracked or burned insulation and exposed conductors.

(2) Inspect transformer casing for cracks, holes, and corrosion.

(3) Inspect for loose, damaged, or missing hardware.

c. Cleaning.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(1) Clean transformer with trichloroethane (item 14, Appendix E).

(2) Allow to dry.

d. Testing.

(1) Connect a multimeter across the primary terminals.

(2) The meter should indicate >0 ohms and <10 ohms.

(3) Connect the multimeter across the secondary terminals.

(4) The meter should indicate $>10{,}000$ ohms and $<24{,}000$ ohms.

e. Installation.

(1) Place transformer (6) and neoprene backing (2) into position on cabinet (3) and secure with four flat washers (7), four lockwashers (8), four screws (4), and four nuts (9).

(2) Connect secondary leads per tagged identification.

(3) Connect primary leads to terminal 4 of TB1 (6) and to terminal 4 of switch (S1).

(4) Install access door per para 3-10d.

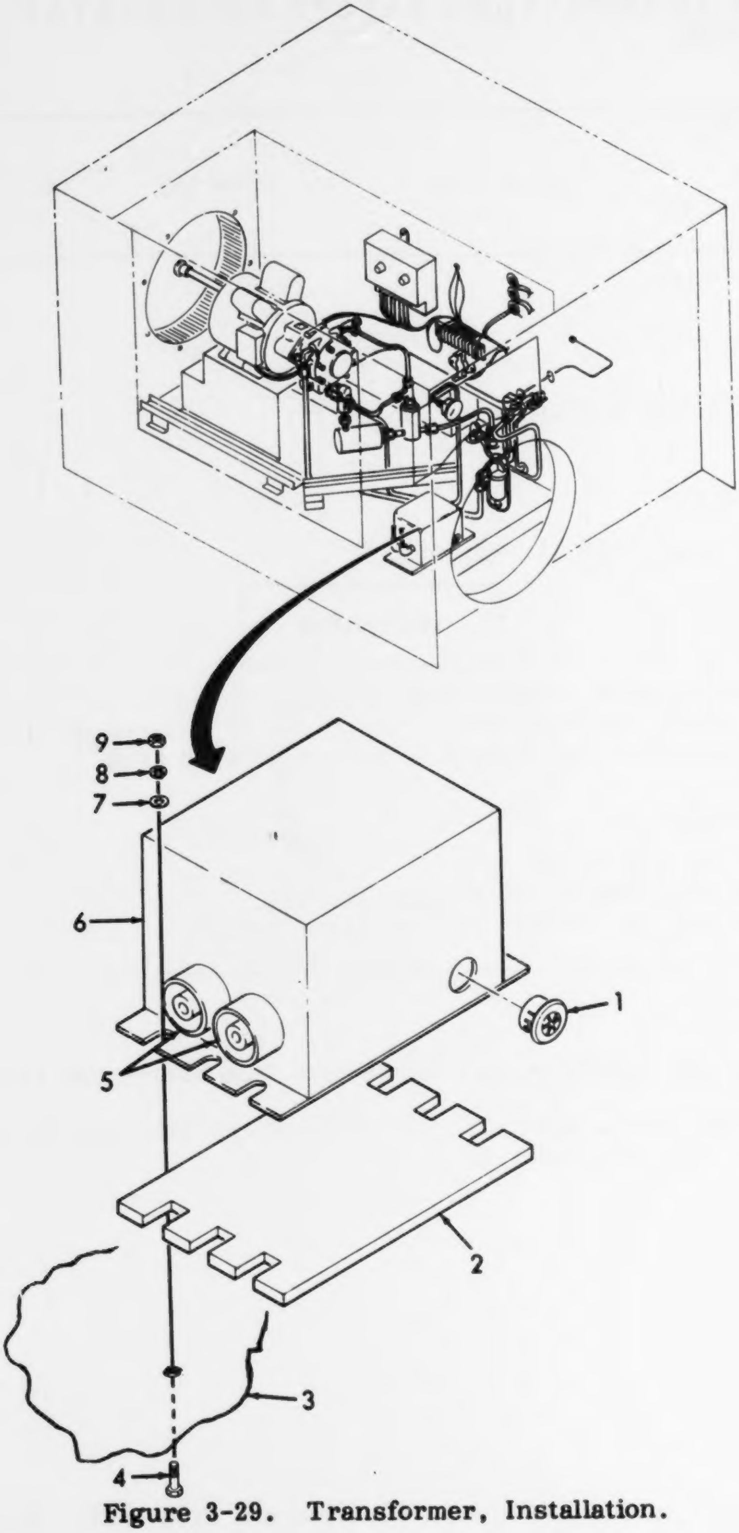

Figure 3-29. Transformer, Installation.

3-27. HIGH TEMPERATURE SAFETY THERMOSTAT MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Testing
e. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics
Multimeter

Materials Required:

Trichloroethane (Item 14, Appendix E)

WARNING

Trichloroethane, Federal Specification 0-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door and air filters removed (para 3-10a).

---

a. Removal.

(1) Tag and disconnect two connectors from thermostat (1).

(2) Remove two screws (2), two lockwashers (3), two flat washers (4), and thermostat (1).

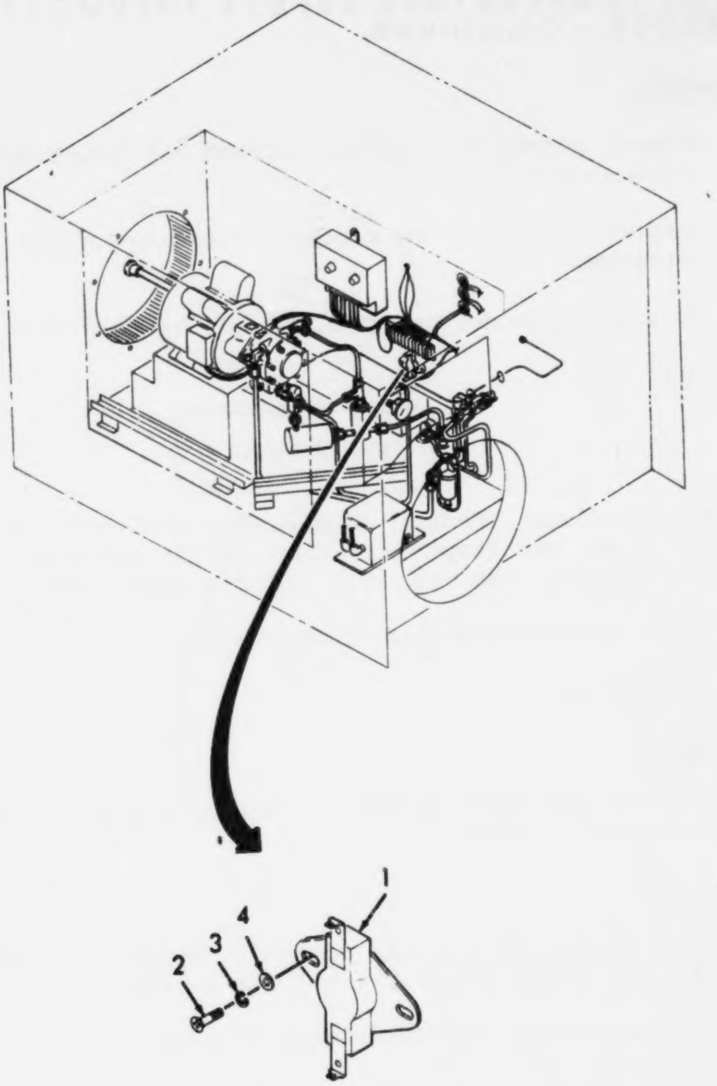

Figure 3-30. High Temperature Safety Thermostat, Removal.

3-27. HIGH TEMPERATURE SAFETY THERMOSTAT MAINTENANCE - Continued.

b. Inspection.

(1) Inspect wiring for cracked, burned, or deteriorated insulation and exposed conductor.

(2) Inspect thermostat for cracks, broken, or burnt terminals, and corrosion.

(3) Inspect for loose, damaged, or missing hardware.

c. Cleaning.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(1) Clean the thermostat in trichloroethane (item 14, Appendix E).

(2) Allow to dry.

d. Testing.

(1) Connect multimeter across thermostat terminals. Meter should indicate $<$ 2 ohms.

e. Installation.

(1) Place thermostat (1) into position. Secure with two flat washers (4), two lockwashers (3), and two screws (2).

(2) Connect wiring per tagged identification.

(3) Install air filters and access door per para 3-10d.

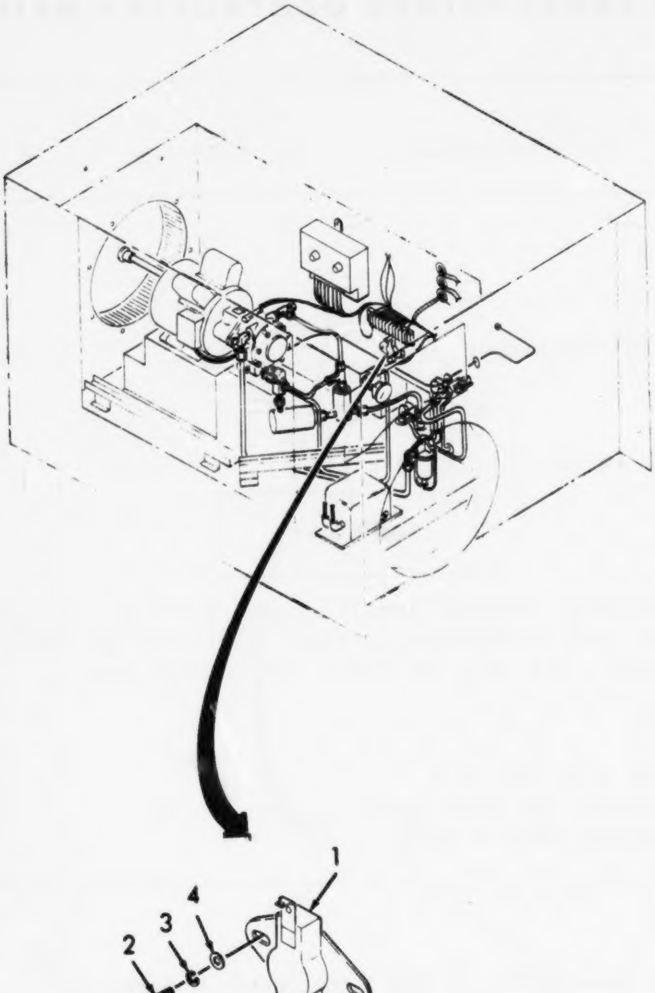

Figure 3-31. High Temperature Safety Thermostat, Installation.

3-28. HEATER TEMPERATURE CONTROLLER MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Trichloroethane (Item 14, Appendix E)

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door removed (para 3-10a).

a. Removal.

(1) Tag and disconnect wiring from terminal strip (2).

(2) Remove two screws (3), two lockwashers (4), two flat washers (5), and temperature controller (1).

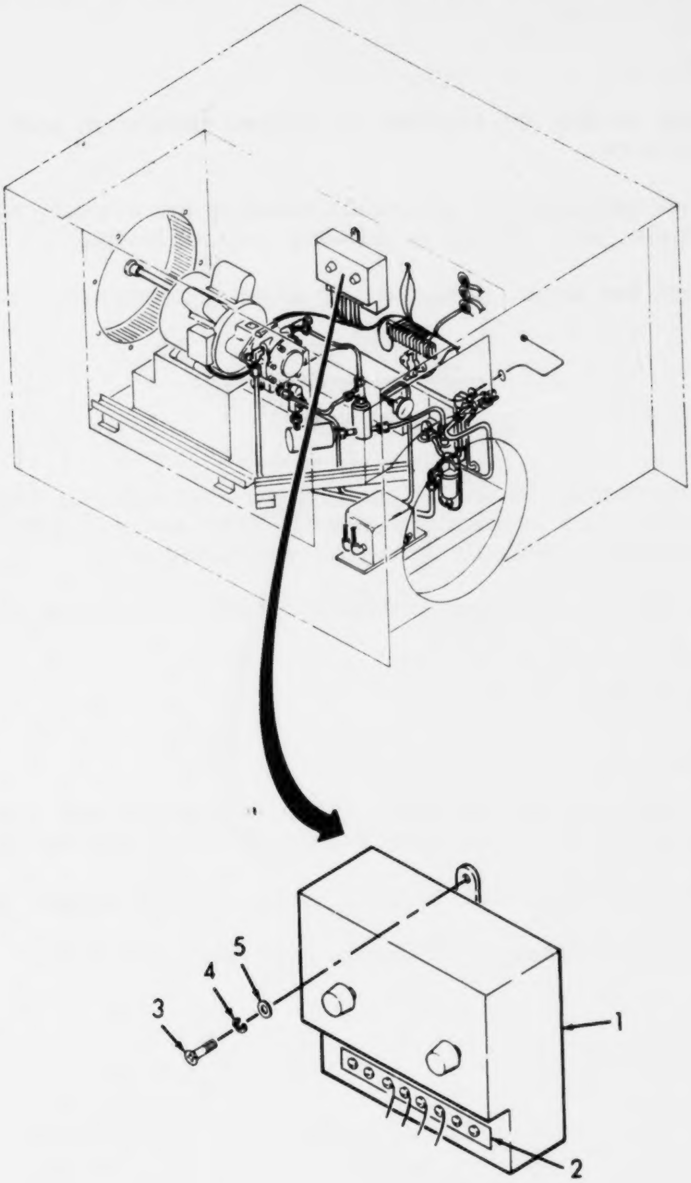

Figure 3-32. Heater Temperature Controller, Removal.

3-28. HEATER TEMPERATURE CONTROLLER MAINTENANCE - Continued.

b. Inspection.

(1) Inspect wiring for cracked or burned insulation and exposed conductors.

(2) Inspect temperature controller housing for cracks, holes, broken terminals, and broken or missing control knobs.

(3) Inspect for loose, damaged, or missing hardware.

c. Cleaning.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(1) Clean the temperature controller in trichloroethane (item 14, Appendix E).

(2) Allow to dry.

d. Installation.

(1) Place temperature controller (1) into position and secure with two flat washers (5), two lockwashers (4), and two screws (3).

(2) Connect wiring to the terminal strip (2) per tagged identification.

(3) Reinstall air filters and access door per para 3-10d.

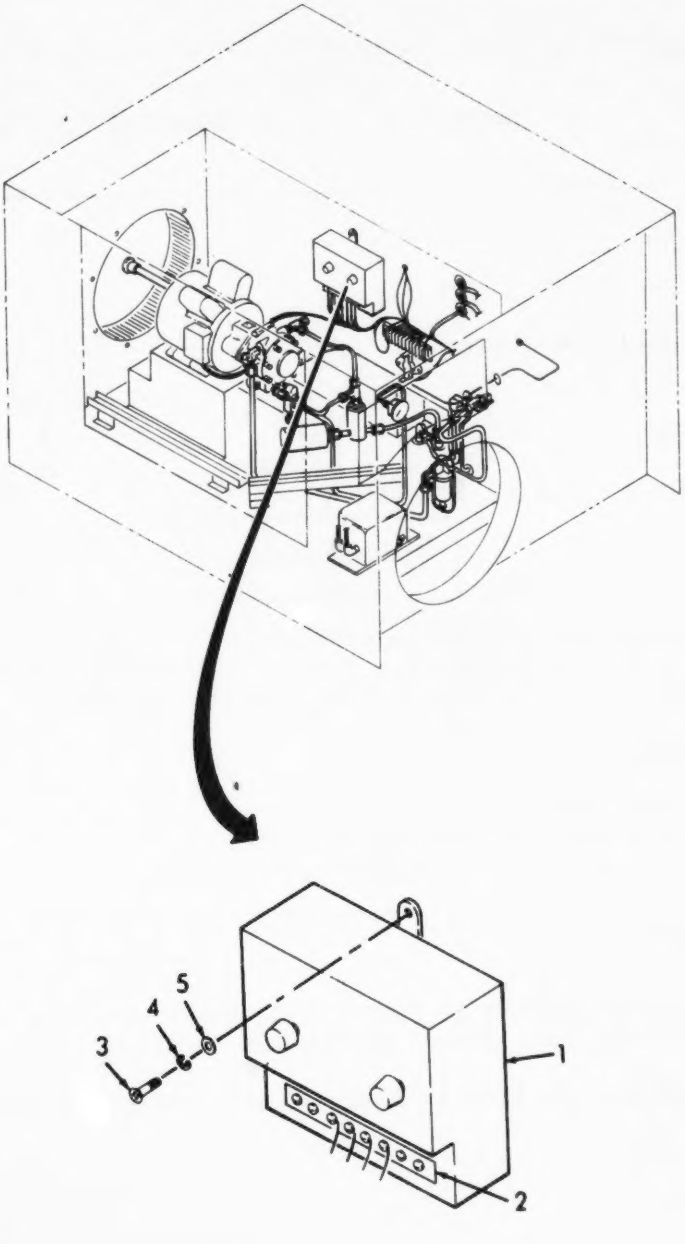

Figure 3-33. Heater Temperature Controller, Installation.

3-29. POWER CABLE ASSEMBLY MAINTENANCE.

This Task Covers:

a. Removal b. Inspection, c. Cleaning d. Repair
e. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics
Multimeter

Materials Required:

Trichloroethane (Item 14, Appendix E)

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door and air filters removed (para 3-10a).

a. Removal.

(1) Disconnect white wire from TB1-1, black wire from TB1-2, and green wire from ground on terminal block (1).

(2) Loosen nut (4) from bushing (3) and pull power cable (2) free.

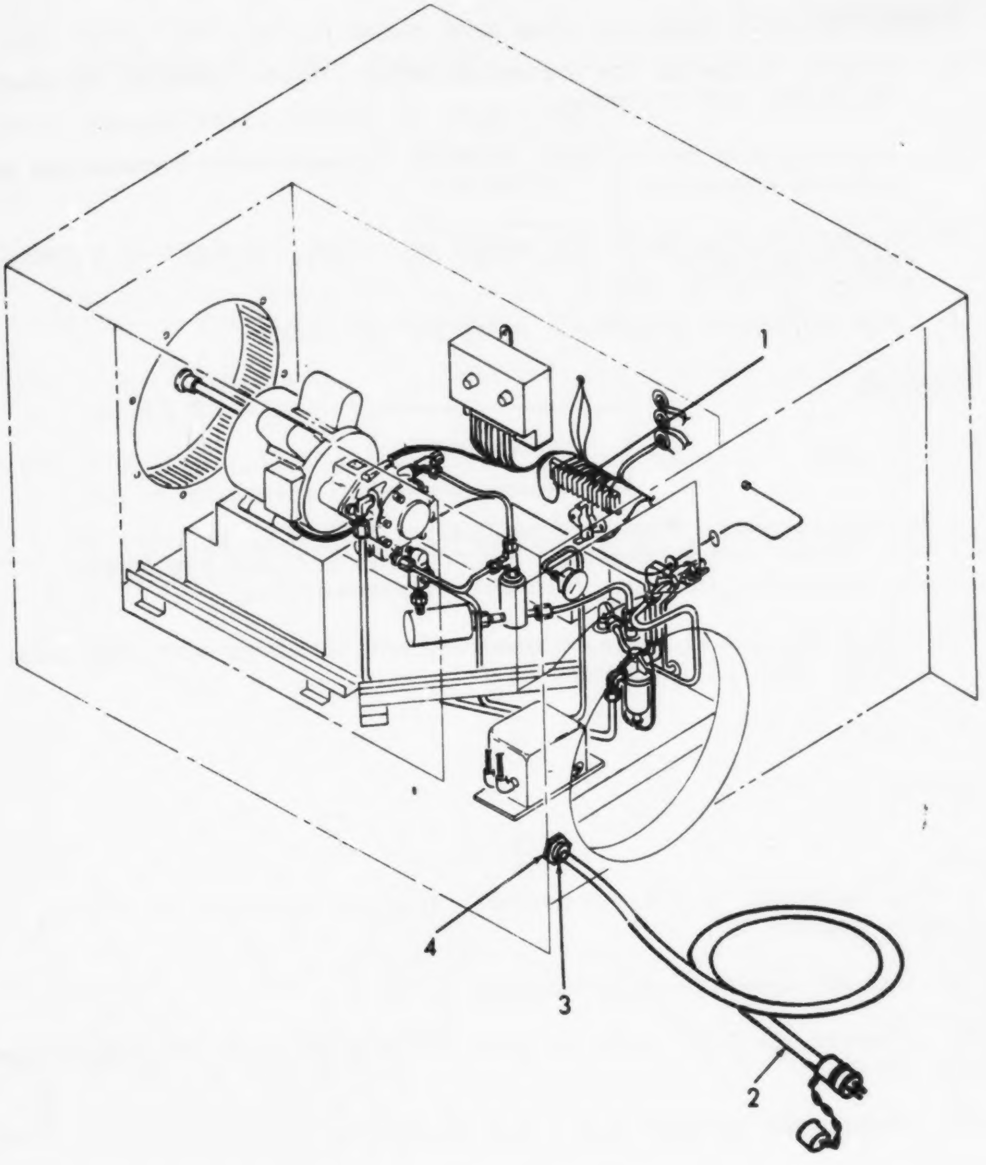

Figure 3-34. Power Cable Assembly, Removal.

3-29. POWER CABLE ASSEMBLY MAINTENANCE - Continued.

b. Inspection.

(1) Inspect connector for secure mounting, burnt, broken, or bent terminals, and corrosion.

(2) Inspect cable for cracked, burned, or deteriorated insulation and exposed conductor.

(3) Inspect lug terminals for secure mounting and signs of burning, and corrosion.

(4) Use multimeter and check wires for continuity.

c. Cleaning.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(1) Clean the power cable, connector, and terminals with trichloroethane (item 14, Appendix E).

(2) Allow to dry.

d. Repair.

NOTE

Plug assembly is not repairable. If it is defective in any way, replace it.

(1) Cut off defective plug assembly (1).

(2) If terminals (12), (13), or (14) are defective cut off defective terminal.

(3) Replace all damaged parts with new parts.

(4) Install new terminals (12), (13), or (14) by stripping wire insulation .25 inch on conductor and crimping new terminal onto wire.

(5) Remove two screws (9) and remove cap and chain (2) from rear end (8) of connector (7).

(6) Slide end of cable (11) through connector (7).

(7) Slide boot (10) onto cable (11).

(8) Strip .75 inch of insulation from cable (11) to expose three insulated wires.

(9) Strip .25 inch insulation from each insulated wire and install terminals (6), (4), and (15).

(10) Remove three screws (5) from plug (3).

WARNING

Always ground green wire onto plug to match the ground blade of the plug. Failure to do so can result in serious injury or death during equipment set up and operation.

(11) Place terminals (6), (4), and (15) into position on plug (3) and install three screws (5).

(12) Pull boot (10) and connector (7) down cable (11) until plug (3) snaps into place inside connector.

(13) Install two screws (9) and cap and chain (2) onto rear end (8) of connector (7).

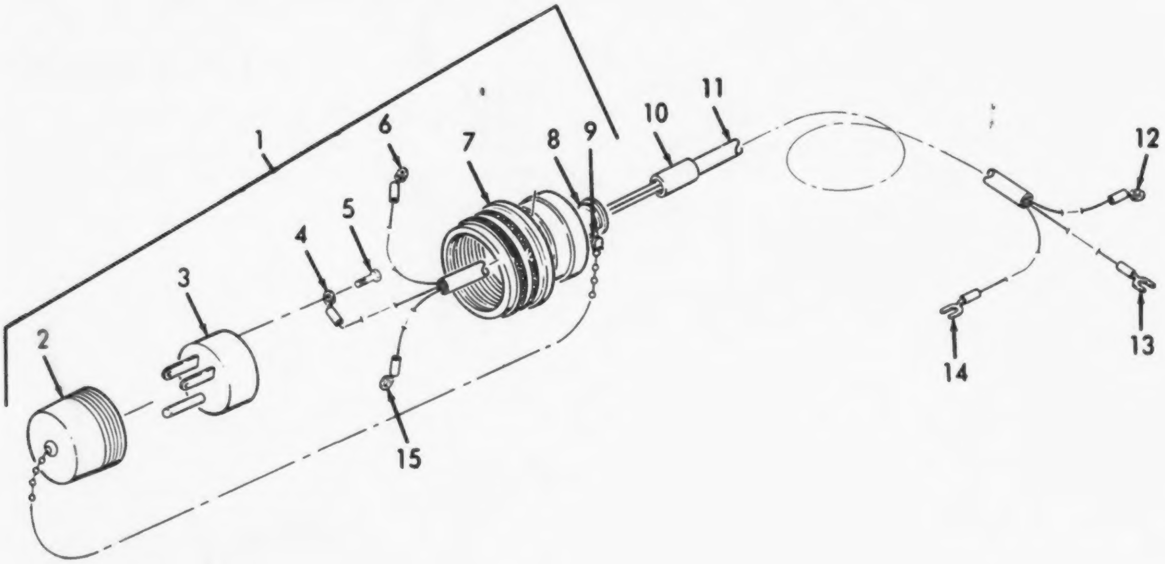

Figure 3-35. Power Cable Assembly, Repair.

3-29. POWER CABLE ASSEMBLY MAINTENANCE - Continued.

e. Installation.

(1) Slide nut (4) on cable (2) and feed cable into heater unit.

(2) Slide bushing (3) onto cable (2) and tighten nut (4).

(3) Connect green wire to ground, black wire to TB1-2, and white wire to TB1-1 of terminal block (1).

(4) Install air filters and access door per para 3-10d.

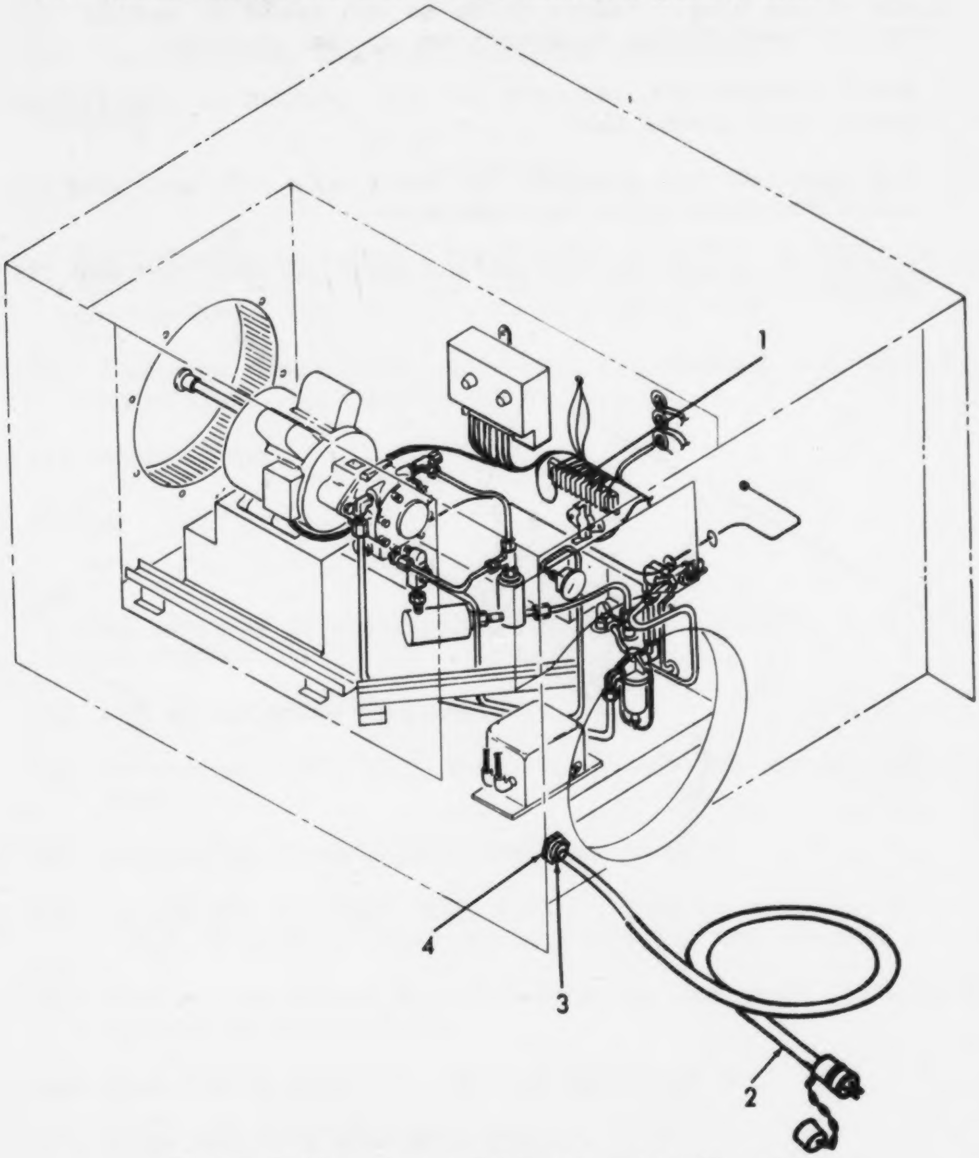

Figure 3-36. Power Cable Assembly, Installation.

3-30. HIGH TENSION CABLE ASSEMBLY MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Repair
e. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics
Multimeter

Materials Required:

Trichloroethane (Item 14, Appendix E)

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door and air filters removed (para 3-10a).

3-30. HIGH TENSION CABLE ASSEMBLY MAINTENANCE - Continued.

a. Removal.

(1) Disconnect cables (8) from transformer (9) terminal.

(2) Remove eight nuts (5), eight lockwashers (4), and eight flat washers (3).

(3) Remove burner cover (6).

(4) Disconnect cables (8) from burner electrodes (7).

(5) Feed cable (8) through heat exchanger (2) and then wall (1) to remove.

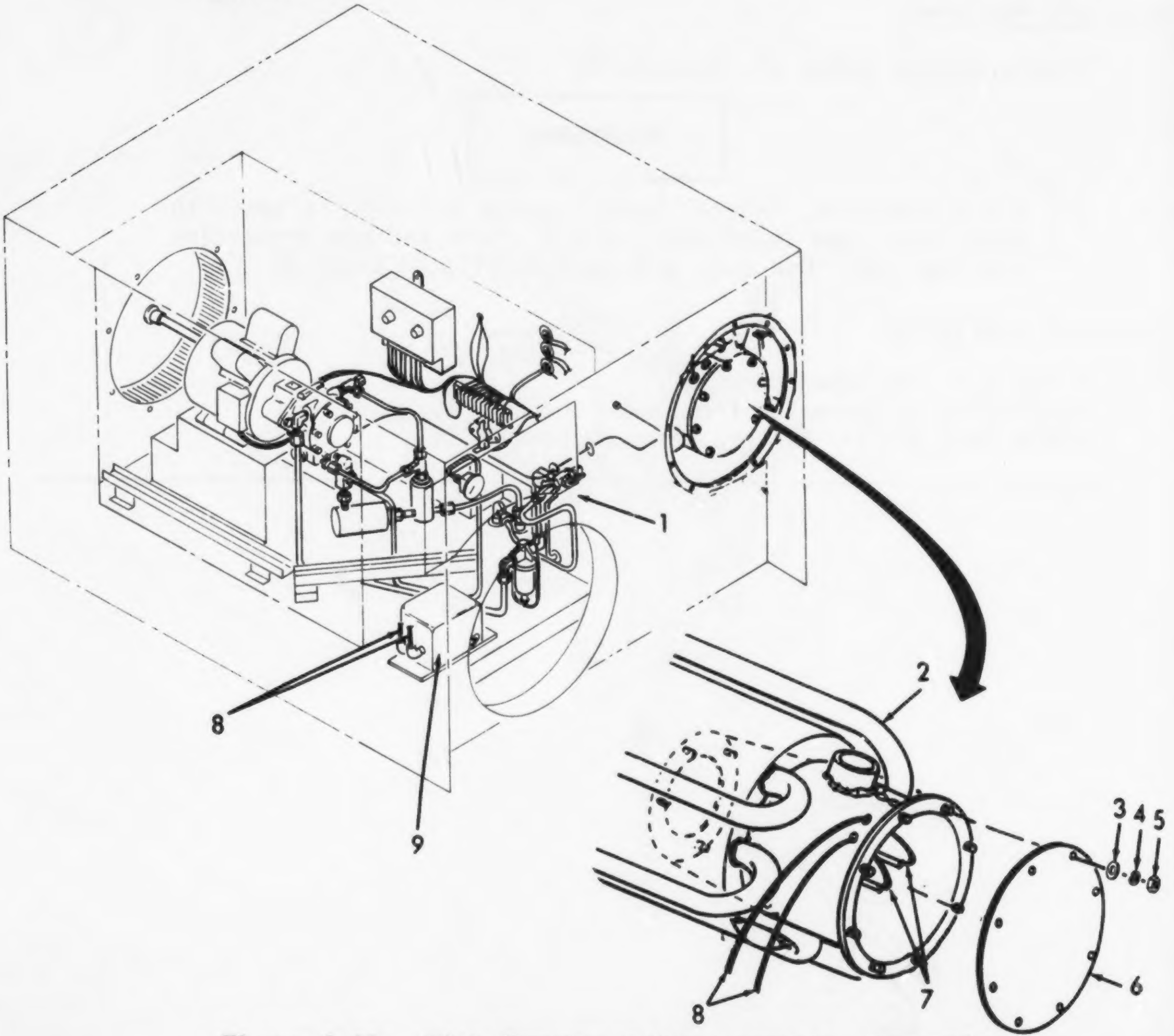

Figure 3-37. High Tension Cable Assembly, Removal.

b. Inspection.

(1) Use multimeter and check cables for continuity.

(2) Inspect connectors for secure mounting, burnt, broken, or bent terminal ends, and corrosion.

(3) Inspect cable for cracked, burned, or deteriorated insulation, and exposed conductor.

(4) Inspect boots for cracks or deteriorated condition.

c. Cleaning.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(1) Clean the cable and terminals with trichloroethane (item 14, Appendix E).

(2) Allow to dry.

3-30. HIGH TENSION CABLE ASSEMBLY MAINTENANCE - Continued.

d. Repair.

(1) Use a sharp knife to cut off sleeving (2).

(2) Slide 90° boot (3) back from terminal (4).

(3) Unsolder terminals (4) then remove 90° boot (3). Repeat for other end for straight boot (6) and terminal (5).

(4) Replace parts as required.

(5) If using a new cable, strip insulation back 1/4 inch.

(6) Slide heat shrink sleeving (2) over cable (1).

(7) Slide 90° boot (3) over cable (1).

(8) Solder terminal (4) to conductor. Repeat for other end for straight boot (6) and terminal (5).

(9) Slide 90° boot (3) over terminal (4) to expose cable insulation. Then apply a thin film of silastic adhesive (item 1, Appendix E) to end of insulation. Repeat for other end.

(10) Slide 90° boot (3) back over insulation. Repeat for other end.

(11) Slide sleeving (2) over 90° boot (3) and apply heat to shrink sleeving.

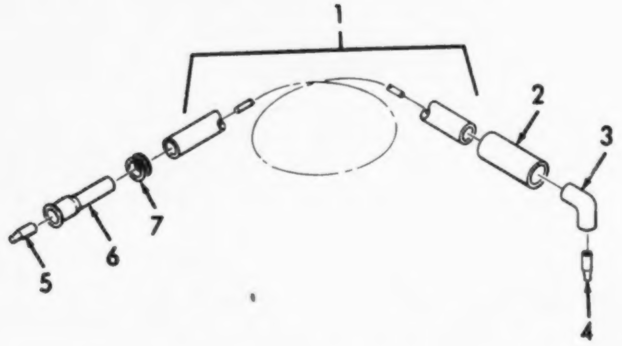

Figure 3-38. High Tension Cable Assembly, Repair.

3-30. HIGH TENSION CABLE ASSEMBLY MAINTENANCE - Continued.

e. Installation.

(1) Feed cable (8) through wall (1) and into heat exchanger (2).

(2) Connect cable (8) to burner electrodes (7).

(3) Place burner cover (6) into position and secure with eight flat washers (3), eight lockwashers (4), and eight nuts (5).

(4) Connect cable (8) to transformer (9) terminal.

(5) Repeat for other cable.

(6) Install air filter and access door per para 3-10d.

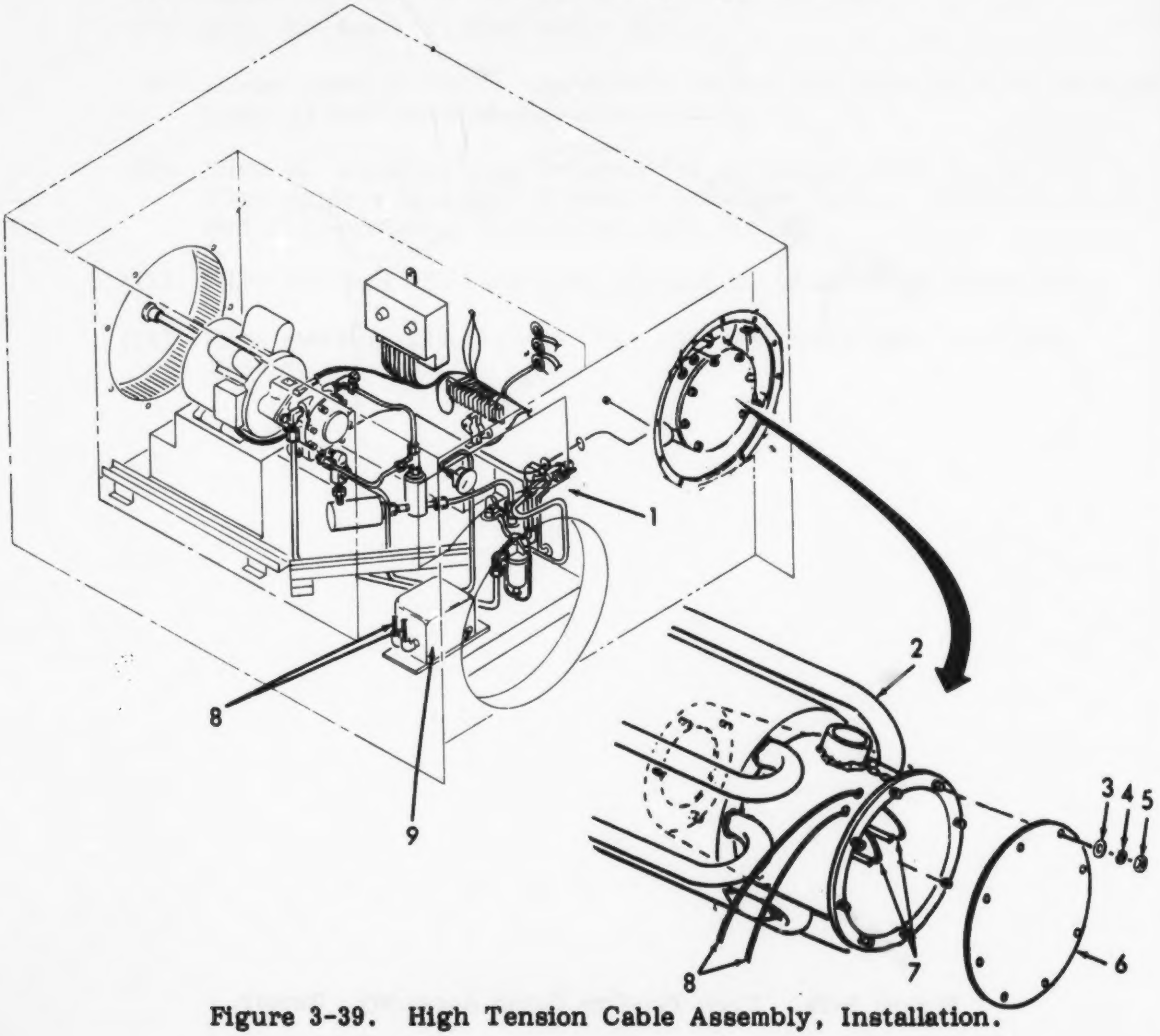

Figure 3-39. High Tension Cable Assembly, Installation.

3-31. DISCHARGE TEMPERATURE THERMOSTAT MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Testing
e. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics
Multimeter

Materials Required:

Trichloroethane (Item 14, Appendix E)

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door and air filters removed (para 3-10a).

3-31. DISCHARGE TEMPERATURE THERMOSTAT MAINTENANCE - Continued.

a. Removal.

(1) Loosen nut (2) then remove thermostat (7) and rod (1).

(2) Remove nut (6), lockwasher (5), and connector (3).

(3) Tag and disconnect leads (8) from terminals 5 and 6 of temperature controller (4).

b. Inspection.

(1) Inspect wiring for cracked, burned, or deteriorated insulation and exposed conductor.

(2) Inspect thermostat body for cracks, damage, and corrosion.

c. Cleaning.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(1) Clean thermostat with trichloroethane (item 14, Appendix E).

(2) Allow to dry.

d. Testing.

(1) Connect a multimeter across the thermostat leads (8).

(2) The resistance of the thermostat is dependent on the temperature and should be within 20 percent of the value listed below.

TEMPERATURE	RESISTANCE
0° F (-18°C)	1000,000
20°F (-7°C)	50,000
40°F (4°C)	25,000
70°F (21°C)	12,000
90°F (32°C)	7,000

e. Installation.

(1) Connect thermostat lead (8) to terminals 5 and 6 of temperature controller (4).

(2) Install lockwasher (5), connector (3), and nut (6).

(3) Install rod (1) leaving 1/2 inch exposed.

(4) Install thermostat (7) leaving 3/8 inch exposed past end of rod.

(5) Tighten nut (2).

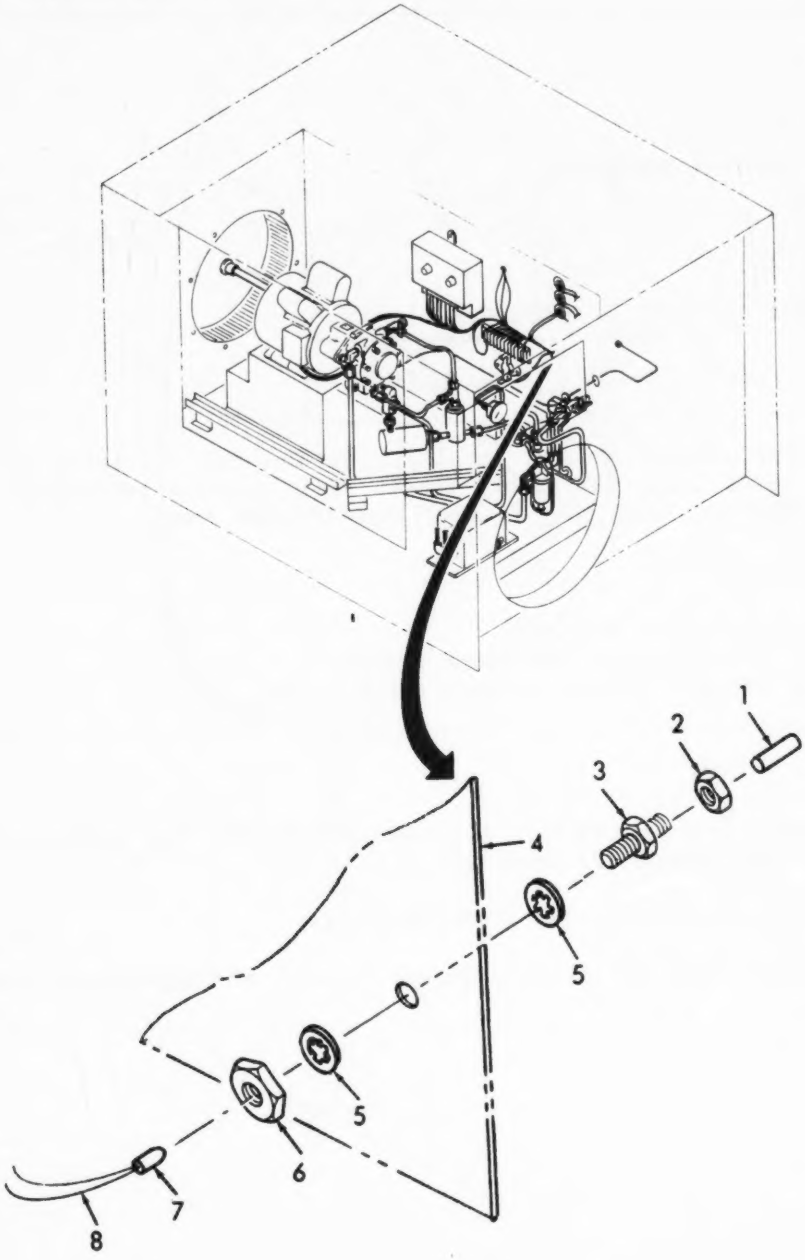

Figure 3-40. Discharge Temperature Thermostat, Removal/Installation.

3-32. RETURN TEMPERATURE THERMOSTAT MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Testing
e. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics
Multimeter

Materials Required:

Trichloroethane (Item 14, Appendix E)

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door and air filters removed (para 3-10a).

a. Removal.

(1) Remove two screws (6), two flatwashers (4), two lockwashers (5), and two clamps (3) from wall (7).

(2) Remove thermostat (1) from clamp (3).

(3) Remove leads (2) from terminals 3 and 4 of temperature controller.

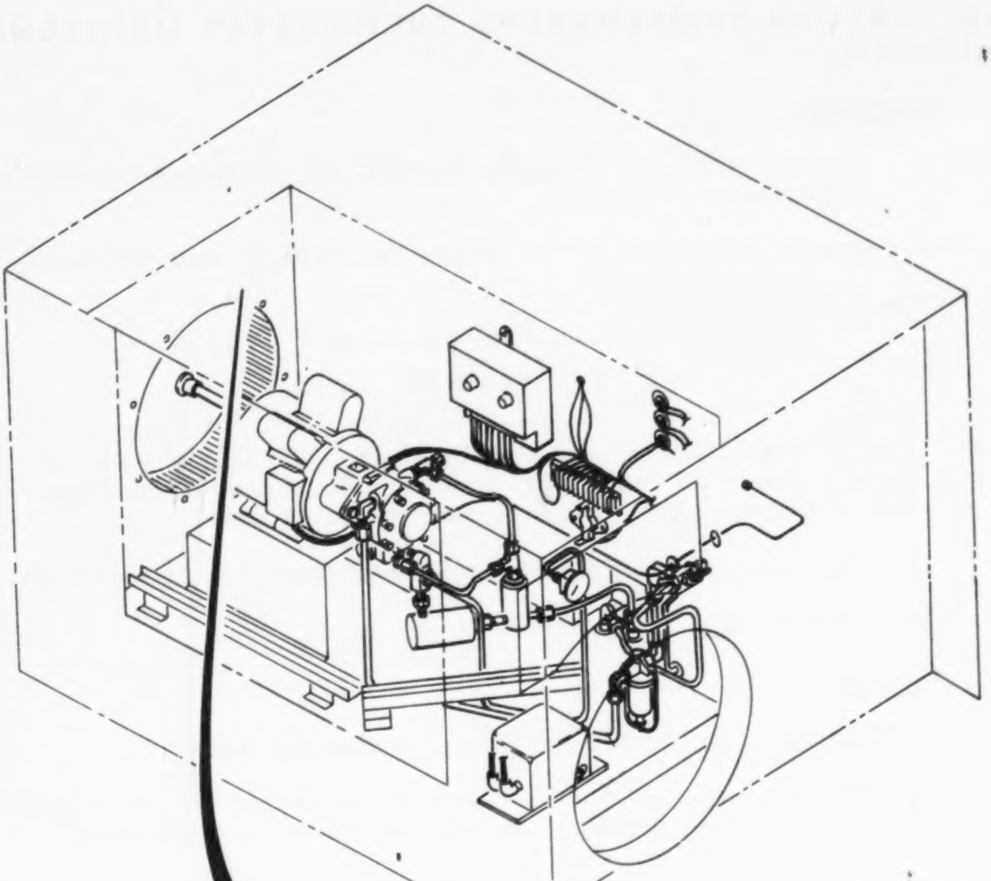

Figure 3-41. Return Temperature Thermostat, Removal.

3-32. RETURN TEMPERATURE THERMOSTAT MAINTENANCE. Continued.

b. Inspection.

(1) Inspect wiring for cracked, burned, or deteriorated insulation, and exposed conductor.

(4) Inspect thermostat body for cracks, damage, and corrosion.

c. Cleaning.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(1) Clean thermostat with trichloroethane (item 14, Appendix E).

(2) Allow to dry.

d. Testing.

(1) Connect a multimeter across the thermostat leads (2).

(2) The resistance of the thermostat is dependent on the temperature and should be within 20 percent of the value listed below.

TEMPERATURE OF	RESISTANCE
0° F (-18°C)	1000,000
20°F (-7°C)	50,000
40°F (4°C)	25,000
70°F (21°C)	12,000
90°F (32°C)	7,000

e. Installation.

(1) Connect thermostat leads (2) to terminals 3 and 4 of temperature controller.

(2) Install thermostat (1) into clamp (3).

(3) Install two screws (6), two lockwashers (5), two flat washers (4), and two clamps (3) onto wall (7).

(4) Install air filters and access door per para 3-10d.

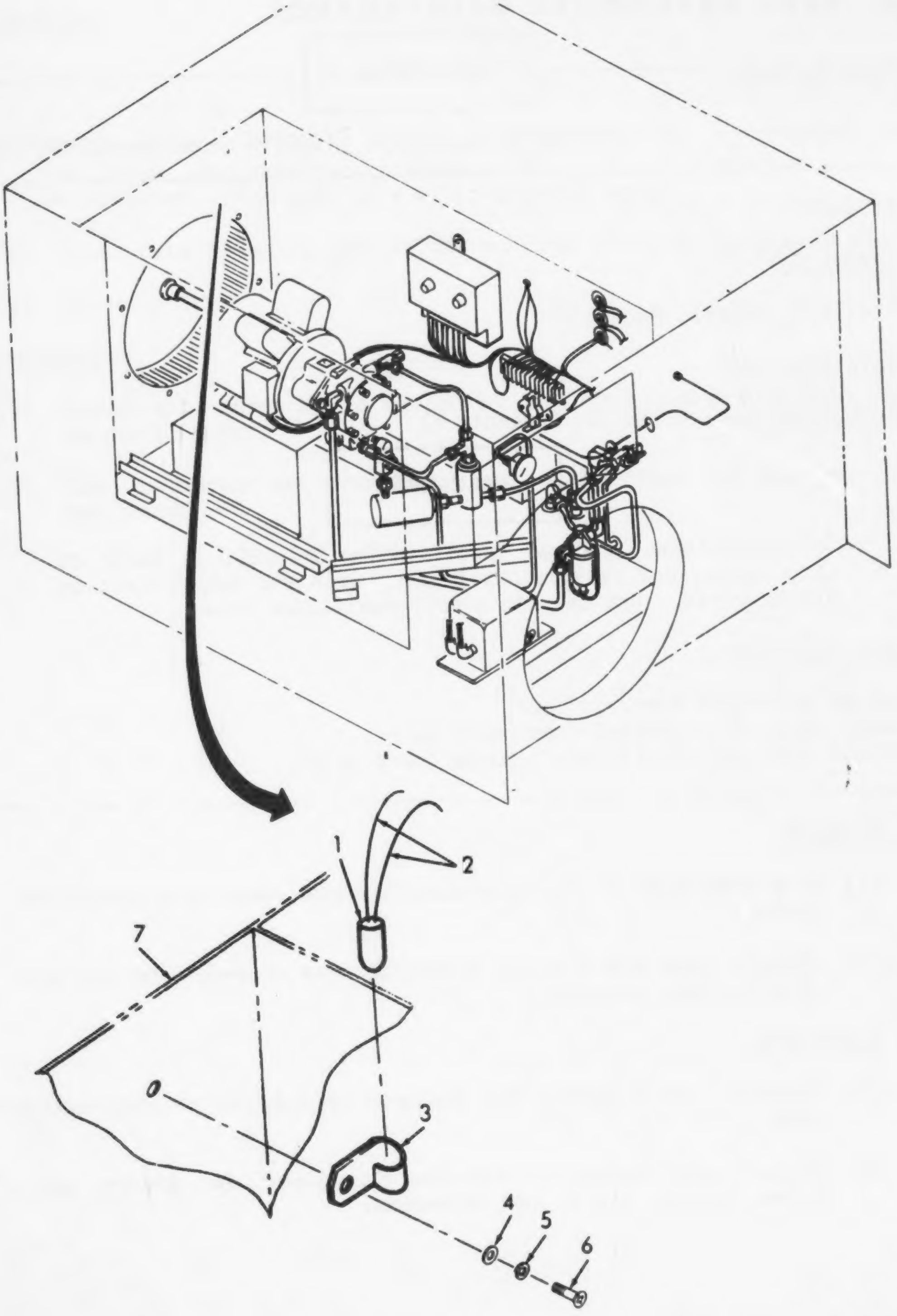

Figure 3-42. Return Temperature Thermostat, Installation.

3-33. TUBE ASSEMBLIES MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Trichloroethane (Item 14, Appendix E)

WARNING

Trichloroethane, Federal Specification 0-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door and air filters removed (para 3-10a).

a. Removal.

(1) Tag both ends of the tube assembly and connection points for tubes.

(2) Remove tube assembly by loosening nuts at each tube end and remove tube assembly.

b. Inspection.

(1) Inspect tube connector for damaged or stripped threads and corrosion.

(2) Inspect tube assembly (including flared end) for cracks, pin holes, bends, dents, and corrosion.

c. Cleaning.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(1) Clean tube assembly with trichloroethane (item 14, Appendix E).

(2) Allow to dry.

d. Installation.

(1) Install tube assembly as tagged by placing flared end of tube onto connector point.

(2) Slide connector nut over flared end, and tighten nut onto connection point.

3-34. SOLENOID VALVES MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Testing
e. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics
Multimeter

Materials Required:

Trichloroethane (Item 14, Appendix E)
Locking Compound (Item 6, Appendix E)

WARNING

Trichloroethane, Federal Specification 0-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door and air filters removed (para 3-10a).

a. Removal.

(1) Tag and disconnect solenoid valve wires (1) from terminal block TB1-8 and TB1-9.

(2) Tag and disconnect wires (7) from TB1-4 and ON/OFF switch S7.

(3) Disconnect tube assemblies (3, 10, 11, and 12) and remove nipple (2).

(4) Unscrew tee (13) and nipple (9). Remove valve (8) from nipple (4).

(5) Remove adapter (6), nipple (4), and valve L1 (5).

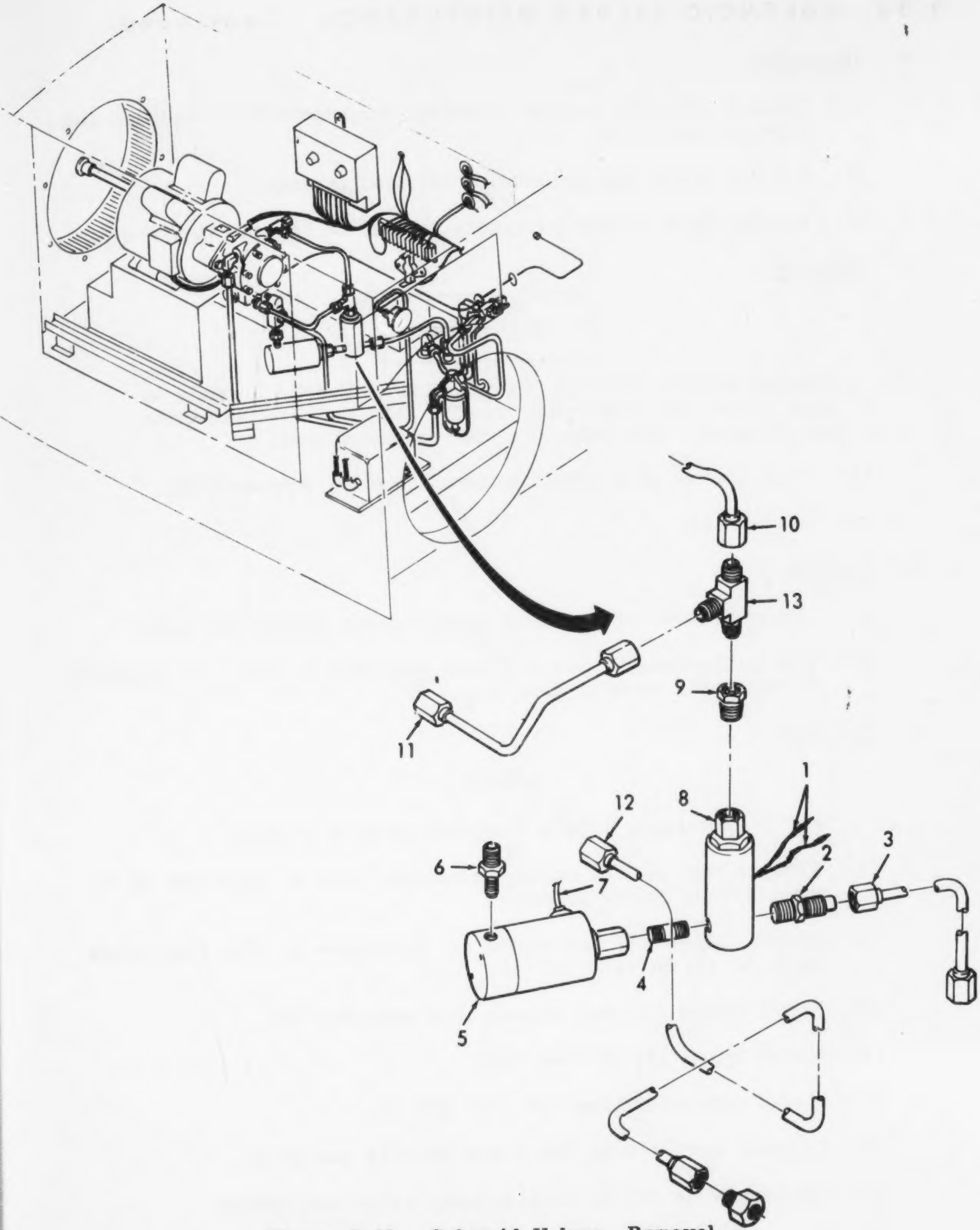
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Figure 3-43. Solenoid Valves, Removal.

3-34. SOLENOID VALVES MAINTENANCE - Continued.

b. Inspection.

(1) Inspect wires for burned, cracked, or deteriorated condition and exposed conductor.

(2) Inspect valves for stripped or damaged threads.

(3) Inspect valve bodies for cracks, holes, dents, and corrosion.

c. Cleaning.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(1) Clean valves with trichloroethane (item 14, Appendix E).

(2) Allow to dry.

d. Testing.

(1) Use multimeter and measure for continuity across the leads.

(2) Use multimeter and measure from each lead to case. If continuity is indicated, valve is defective.

e. Installation.

NOTE

Do not apply locking compound to tube threads.

(1) Apply a thin coat of locking compound (item 6, Appendix E) to pipe threads before assembly.

(2) Install adapter (6) and nipple (4) into valve L1 (5), then screw valve L1 (5) to valve L2 (8).

(3) Install nipple (2) and connect tube assembly (3).

(4) Install nipple (9) and tee (13).

(5) Install tube assemblies (10, 11, and 12).

(6) Connect wires (7) to TB1-4 and ON/OFF switch S7.

(7) Connect wires (1) to terminal strip TB1-8 and TB1-9.

(8) Install air filters and access door per para 3-10d.

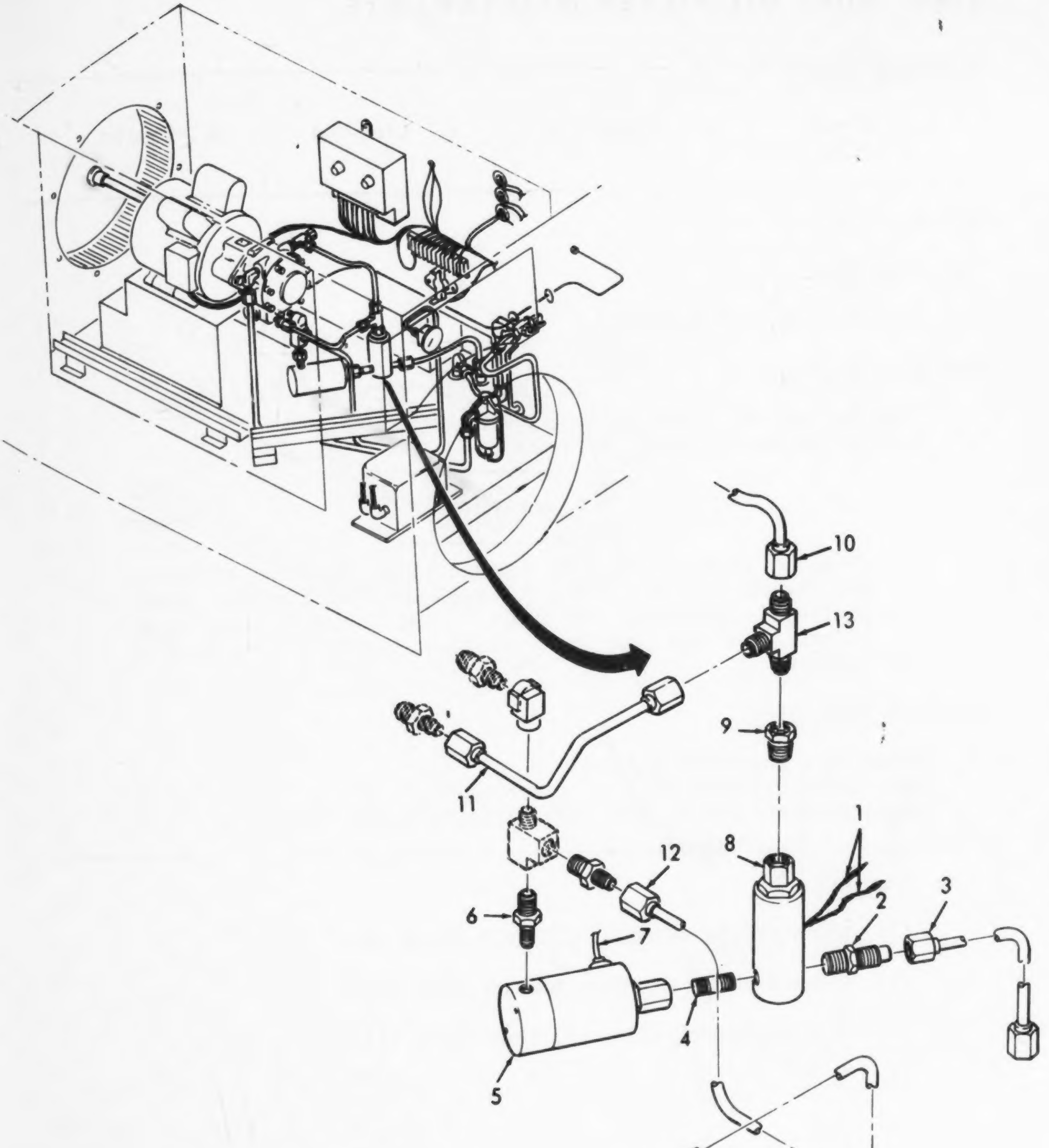
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Figure 3-44. Solenoid Valves, Installation.

3-35. FUEL OIL FILTER MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Repair
e. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Cleaning Solvent (Item 11, Appendix E)
Locking Compound (Item 6, Appendix E)

WARNING

Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Access door and air filters removed (para 3-10a).

---

a. Removal.

(1) Remove tube assembly (2) from elbow (3).

(2) Remove elbow (3) from fuel oil filter (4).

(3) Remove fuel oil filter (4) from elbow (1).

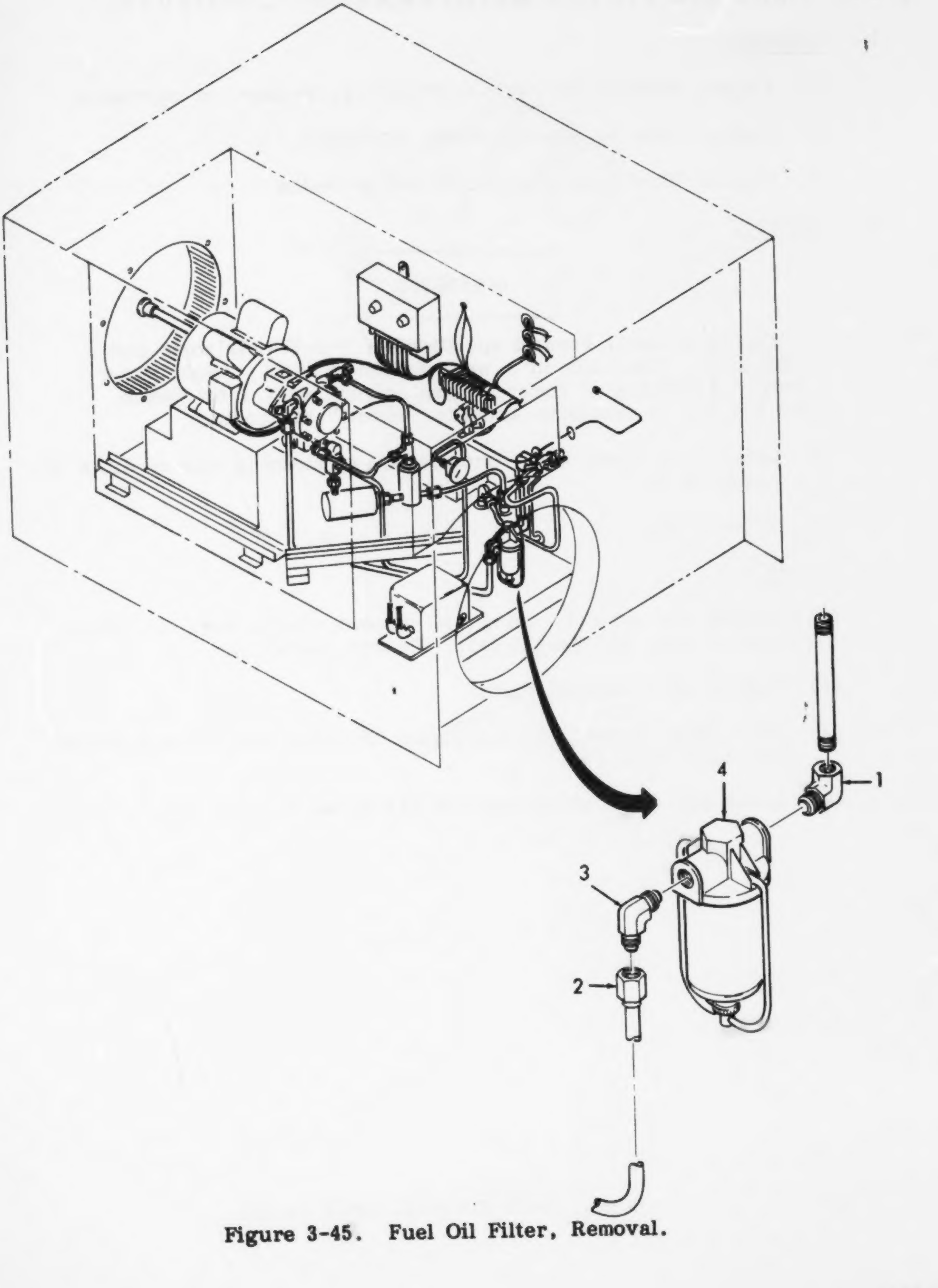

Figure 3-45. Fuel Oil Filter, Removal.

3-35. FUEL OIL FILTER MAINTENANCE - Continued.

b. Inspection.

(1) Inspect threads for signs of stripping, damage, or corrosion.

(2) Inspect bowl for cracks, holes, and leaks.

(3) Inspect filter head for cracks and corrosion.

c. Cleaning.

WARNING

Cleaning solvent, Federal specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

(1) Clean filter boss, bowl, and element in cleaning solvent (item 11, Appendix E).

(2) Allow to dry.

d. Repair.

(1) Loosen bail nut (1), swing bail up and remove bowl (2), filter element (3), and gasket (4). Discard gasket (4).

(2) Replace any damaged items.

(3) Place filter element (3) and gasket (4) into bowl (2) and install into filter head (5).

(4) Lower bail and tighten bail nut (1) to secure bowl (2).

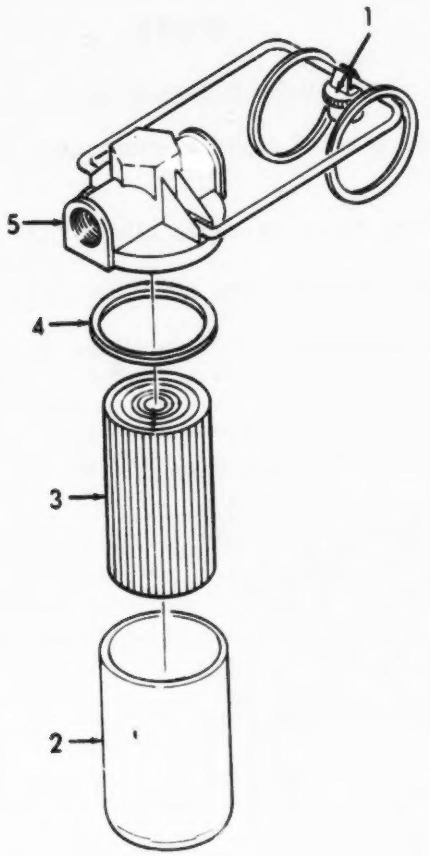

Figure 3-46. Fuel Oil Filter, Repair.

3-35. FUEL OIL FILTER MAINTENANCE - Continued.

e. Installation.

NOTE

Do not apply locking compound to tube threads.

(1) Apply a thin coat of locking compound (item 6, Appendix E) to pipe threads.

(2) Install fuel oil filter (4) onto elbow (1).

(3) Install elbow (3) onto fuel oil filter (4).

(4) Install tube assembly (2) onto elbow (3).

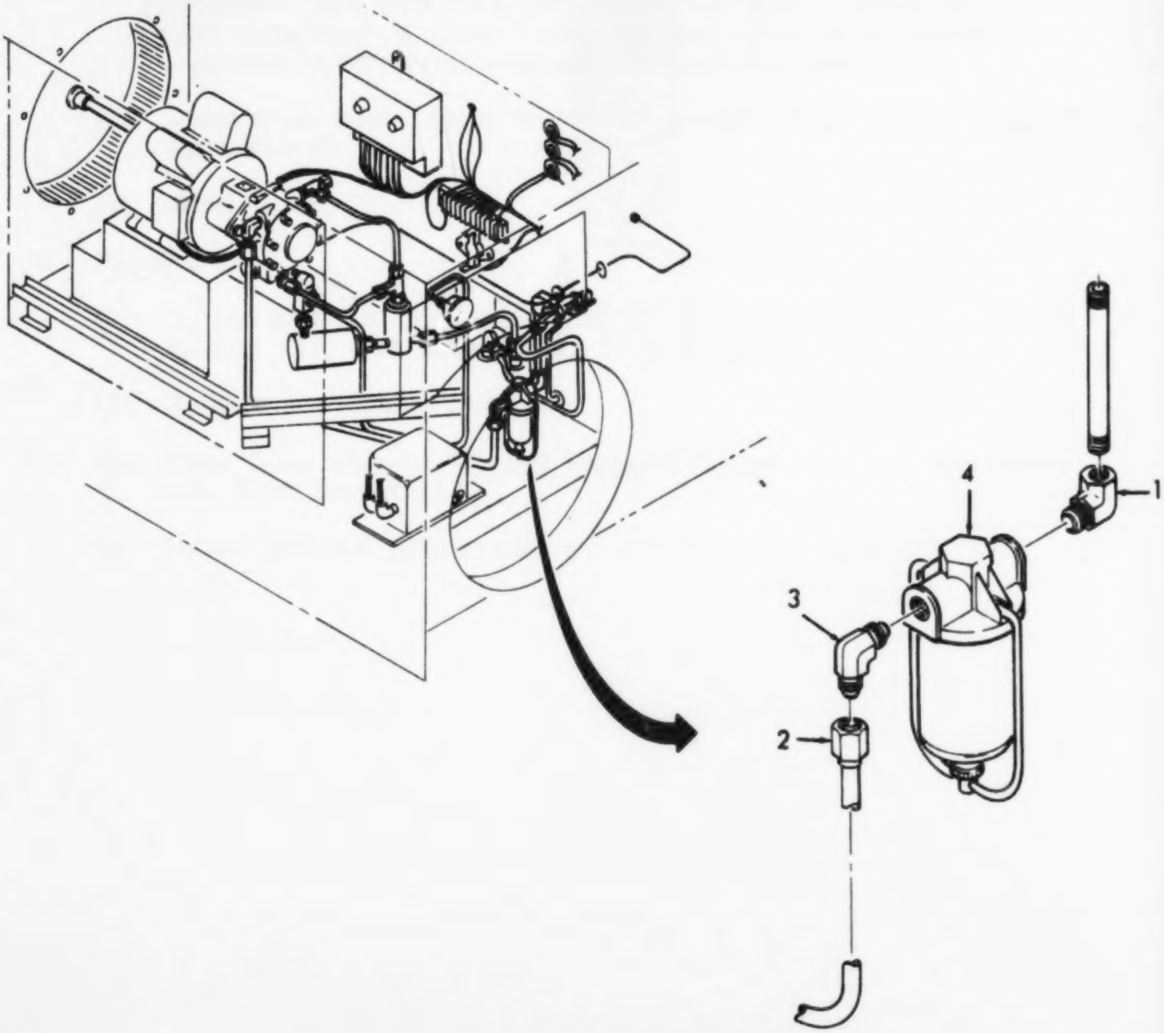

Figure 3-47. Fuel Oil Filter, Installation.

3-36. SIGHTGLASS MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Cleaning Solvent (Item 11, Appendix E)
Glass Cleaner (Item 3, Appendix E)

WARNING

Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.

3-36. SIGHTGLASS MAINTENANCE - Continued.

a. Removal.

(1) Lift up cover (1).

(2) Unscrew and remove sightglass (3) from fitting (2).

b. Inspection.

(1) Inspect sightglass threads for signs of stripping, damage, or corrosion.

(2) Inspect sightglass for cracks, and corrosion on metal.

c. Cleaning.

WARNING

Cleaning solvent, Federal specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

(1) Clean sightglass metal part with cleaning solvent (item 11, Appendix E).

(2) Allow to dry.

(3) Clean glass part of sightglass with glass cleaner (item 3, Appendix E).

d. Installation.

(1) Install sightglass (3) and tighten securely into fitting (2).

(2) Close sightglass cover (1).

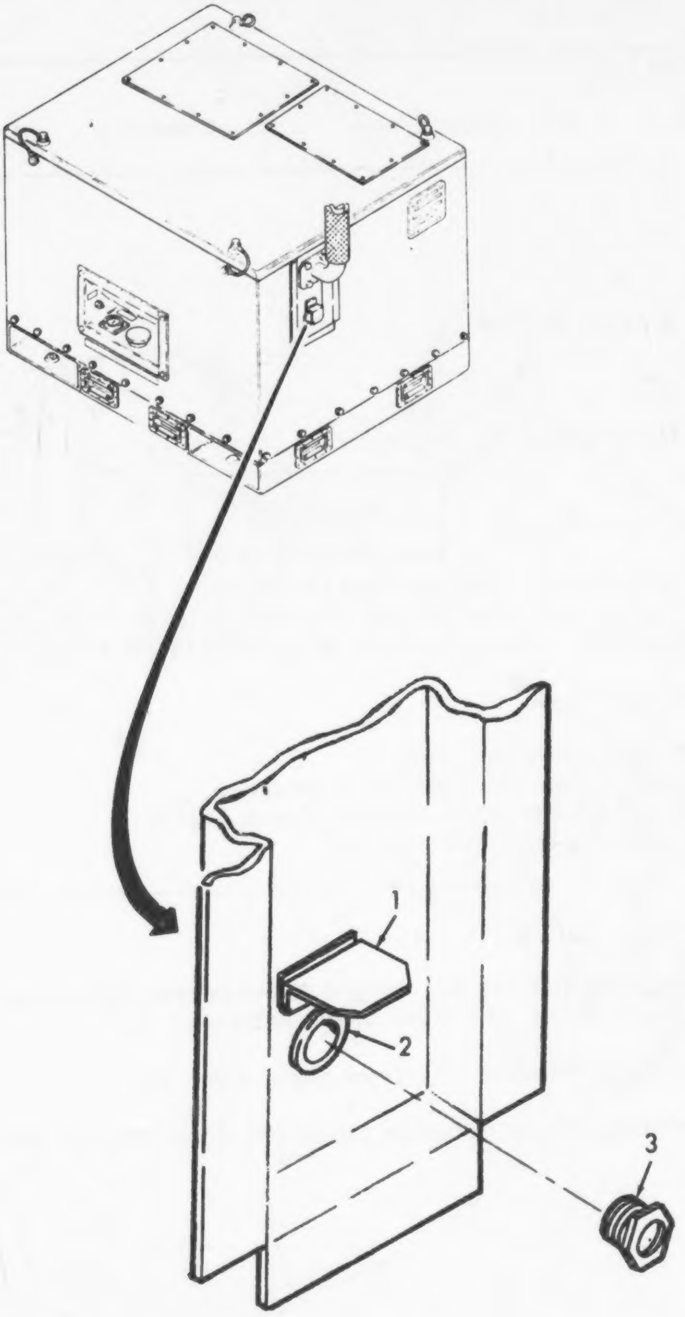

Figure 3-48. Sightglass, Removal/Installation.

3-37. FLAME DETECTOR MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Trichloroethane (Item 14, Appendix E)

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Air filters and access door removed (para 3-10a).
Supply and return air ducts removed.

---

a. Removal.

(1) Remove eight nuts (5), eight lockwashers (4), eight flat washers (3), and cover (2) from heat exchanger (1).

(2) Pull flame detector (7) from sight tube (6).

(3) Disconnect flame detector leads (8) from TB1-11 and TB1-12.

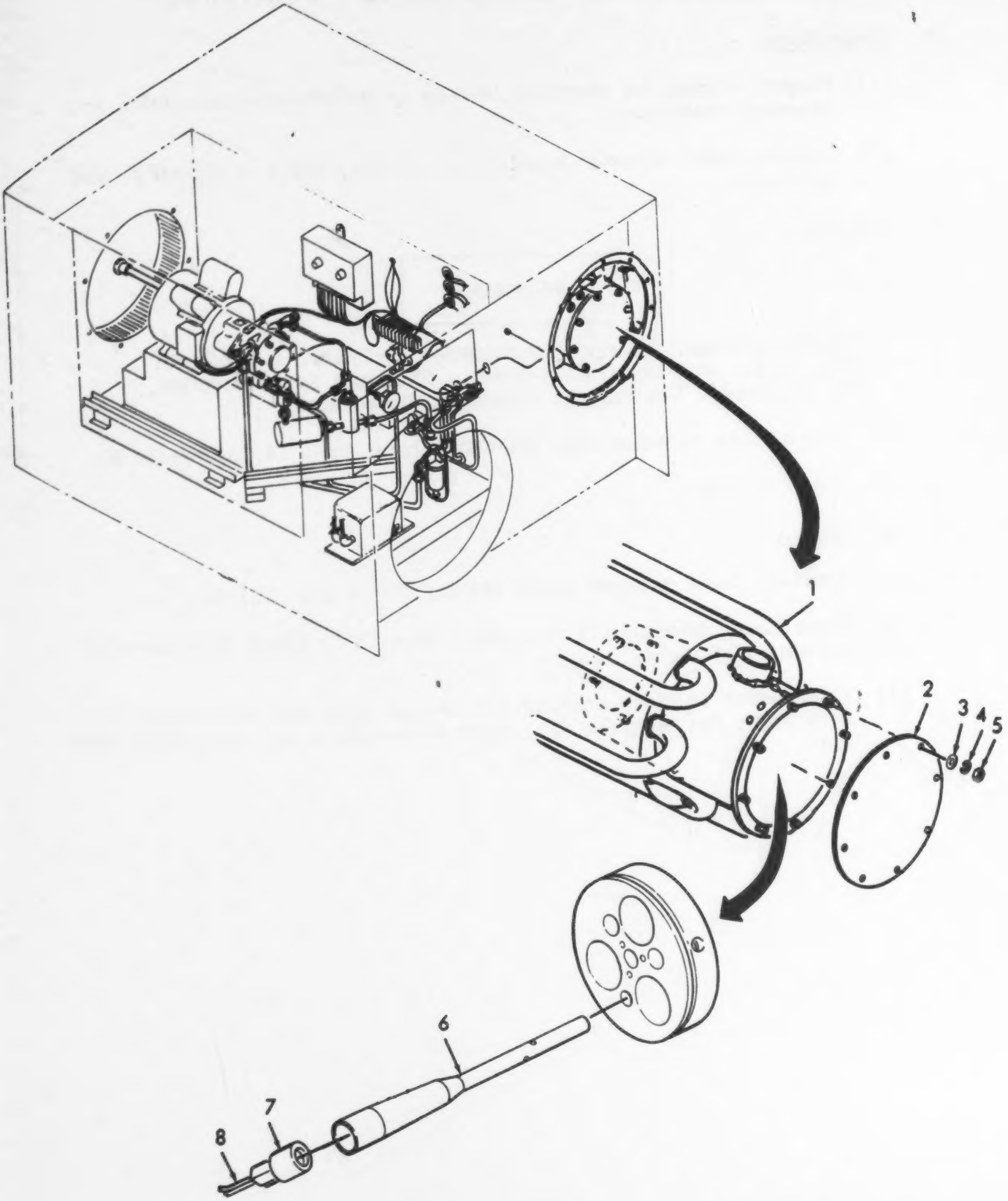

Figure 3-49. Flame Detector, Removal.

3-37. FLAME DETECTOR MAINTENANCE - Continued.

b. Inspection.

(1) Inspect wiring for cracked, broken or deteriorated insulation and exposed conductor.

(2) Inspect flame detector housing for cracks, signs of burning, and corrosion.

c. Cleaning.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(1) Clean flame detector with trichloroethane (item 14, Appendix E).

(2) Allow to dry.

d. Installation.

(1) Connect flame detector leads (8) to TB1-11 and TB1-12.

(2) Push flame detector (7) into sight tube (6). Flame detector must be alined straight.

(3) Place cover (2) into position and secure onto heat exchanger (1) with eight flat washers (3), eight lockwashers (4), and eight nuts (5).

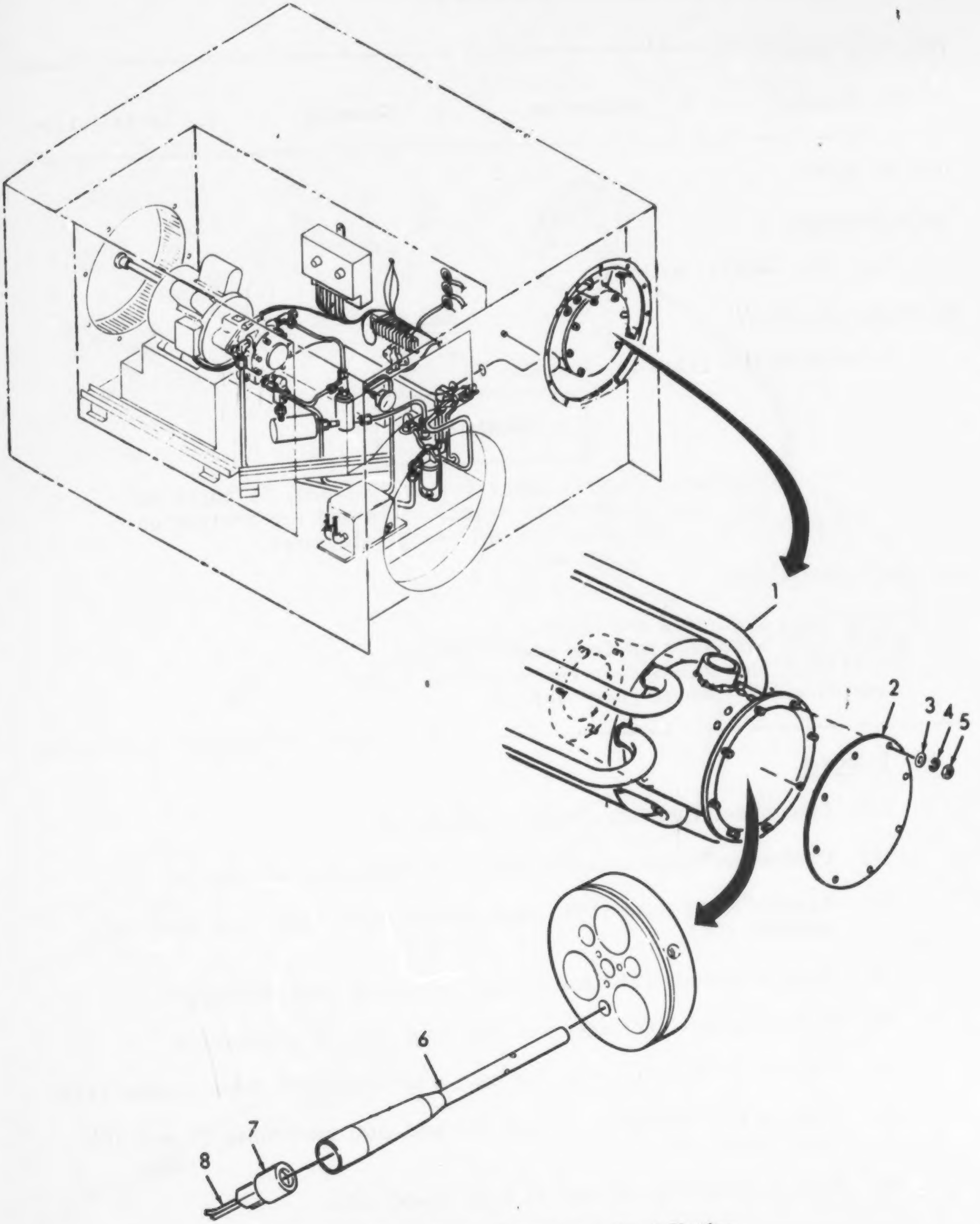

Figure 3-50. Flame Detector, Installation.

3-38. ELECTRODE MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Trichloroethane (Item 14, Appendix E)

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Air filters and access door removed (para 3-10a).
Flame detector removed (para 3-37a).

a. Removal.

(1) Disconnect fuel line (1) from nozzle (2).

(2) Disconnect ignition leads from both electrodes (7 and 10).

(3) Remove eight nuts (18), eight lockwashers (19), and eight flat washers (20).

(4) Remove burner (14) and gasket (21) from heat exchanger.

(5) Remove screw (13) and pull fire ring (15) from assembly.

(6) Remove three setscrews (12) and pull block (16) from burner (14).

(7) Remove two setscrews (5 and 17) and pull electrodes (7 and 10) from block (16).

(8) Remove bushings (3 and 4) from block (16).

(9) Remove studs (6 and 9) and o-rings (8 and 11) from electrodes (7 and 10).

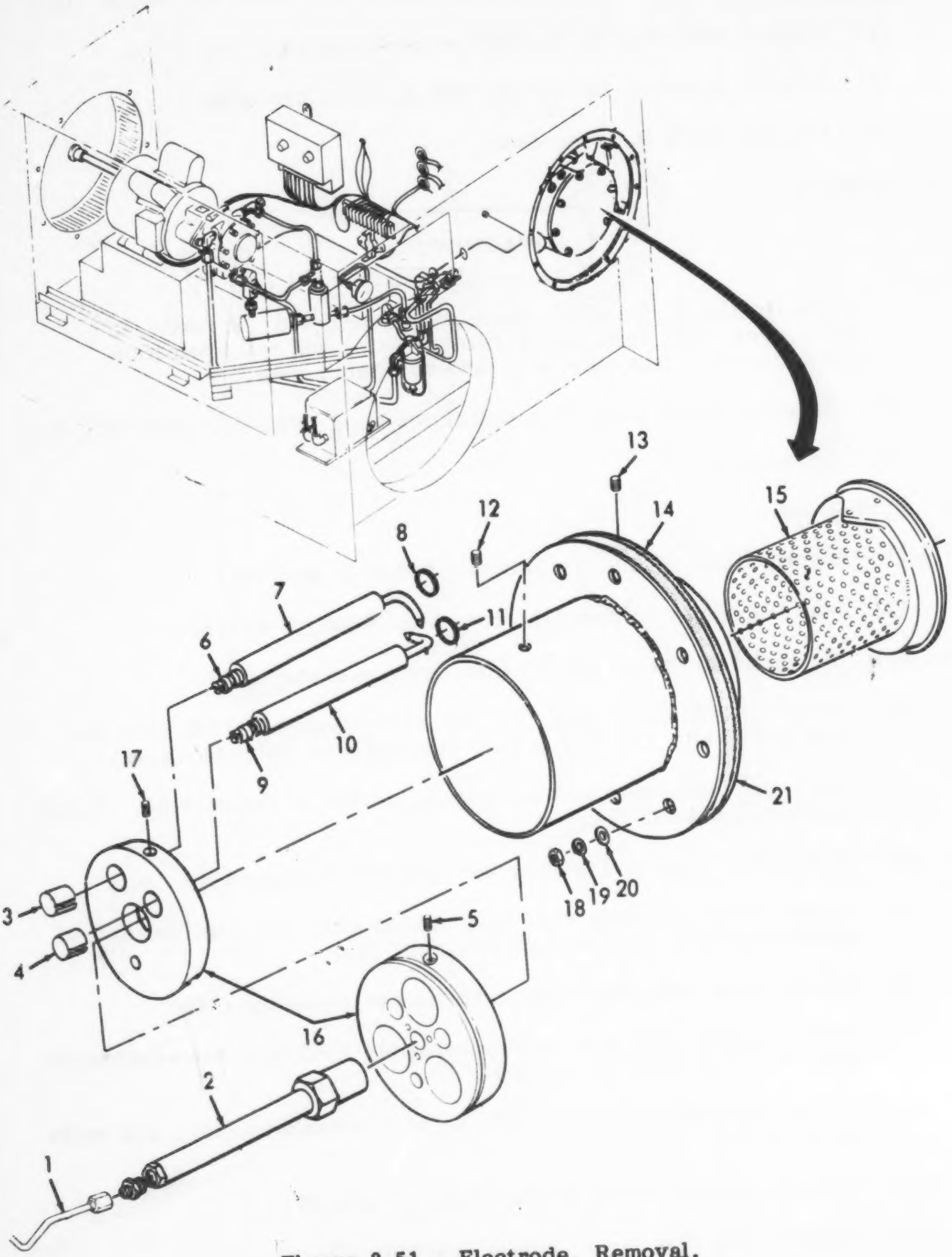
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Figure 3-51. Electrode, Removal.

3-38. ELECTRODE MAINTENANCE - Continued.

b. Inspection.

(1) Inspect electrode for burned or corroded tip.

(2) Inspect insulator for cracks and signs of arc-over.

(3) Inspect studs for corrosion.

c. Cleaning.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(1) Clean all metal parts with trichloroethane (item 14, Appendix E).

(2) Allow to dry.

d. Installation.

(1) Install studs (6 and 9) into electrodes (7 and 10).

(2) Install o-rings (8 and 11), onto electrodes (7 and 10).

(3) Install bushings (3 and 4) into block assembly (16).

(4) Install electrodes (7 and 10) into block assembly (16) with the o-rings (8 and 11) fitting half-way into the small block.

(5) Aline the electrodes and set gap as shown in figure 3-53. Install setscrews (5 and 17).

(6) Install fire ring (15) and screw (13) into burner (14).

(7) Install block assembly (16) into burner (14) and position end of nozzle one inch from end of fire ring (15).

(8) Install three setscrews (12) into burner assembly (14).

(9) Install gasket (21) and burner assembly (14) into heat exchanger with the electrodes at the top.

(10) Install eight flat washers (20), eight lockwashers (19), and eight nuts (18).

(11) Connect ignition leads to electrodes (7 and 10).

(12) Connect fuel line (1) to nozzle assembly (2).

(13) Install flame detector per para 3-37d.

(14) Install air filter and access door per para 3-10d.

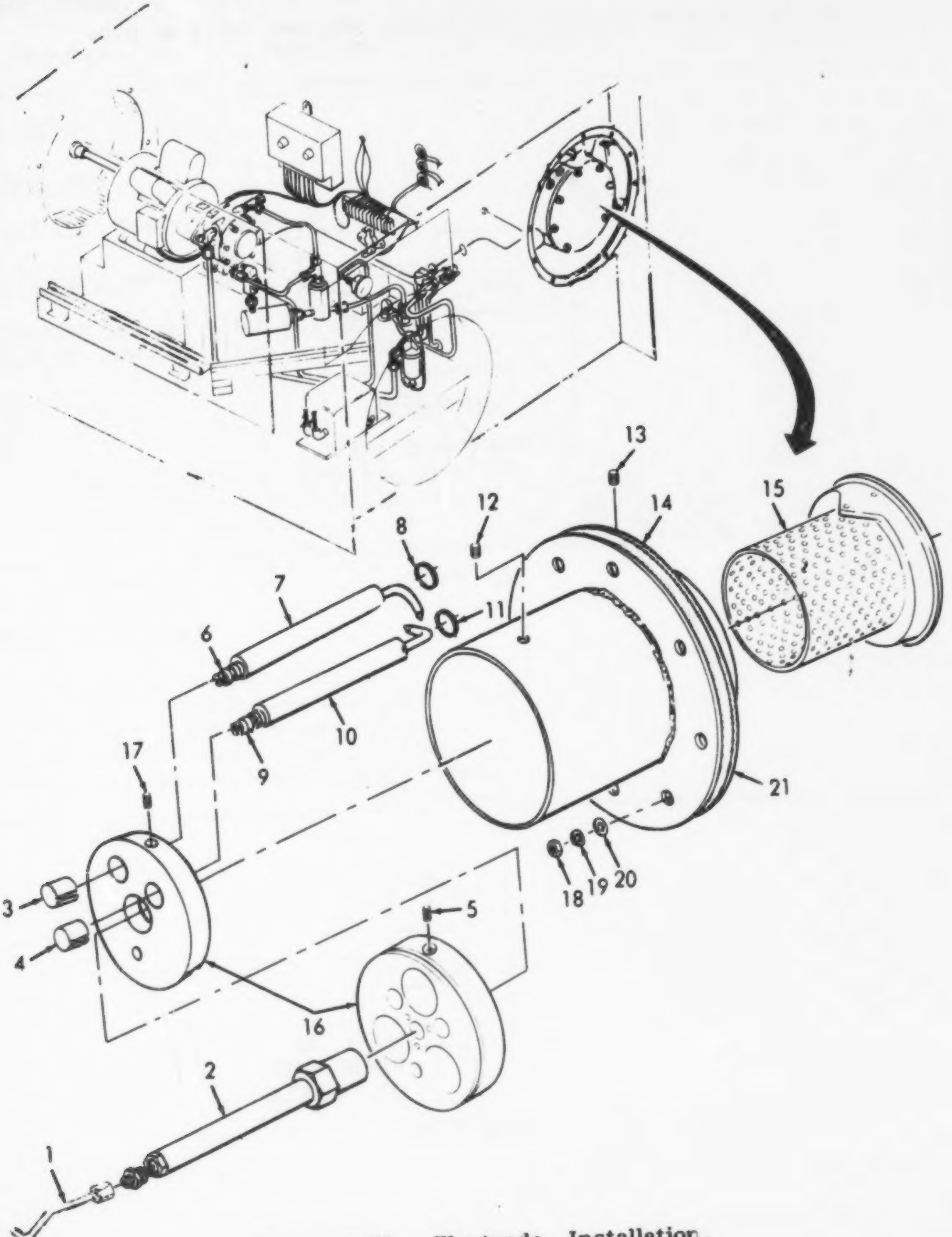
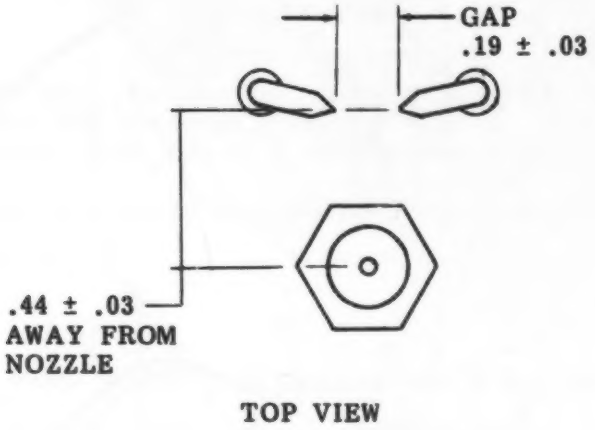

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21

Figure 3-52. Electrode, Installation.

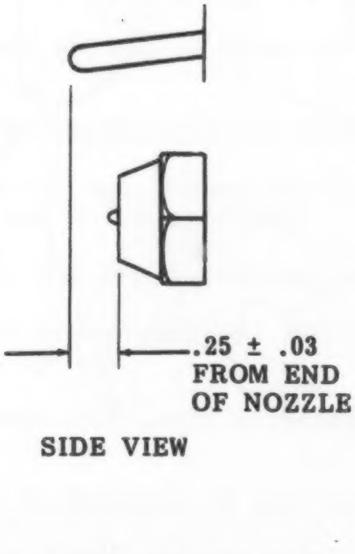
3-38. ELECTRODE MAINTENANCE - Continued.

NOTE

If not properly gapped, the heater will not function properly.



GAP
.19 ± .03
.44 ± .03
AWAY FROM
NOZZLE
TOP VIEW



.25 ± .03
FROM END
OF NOZZLE
SIDE VIEW

Figure 3-53. Electrode Gap Setting.

3-39. NOZZLE MAINTENANCE.

This Task Covers:

a. Removal   b. Inspection   c. Cleaning   d. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Cleaning Solvent (Item 11, Appendix E)
Locking Compound (Item 6, Appendix E)

WARNING

Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Air filters and access door removed (para 3-10a).
Flame detector removed (para 3-37a).
Electrodes removed (para 3-38a).

3-39. NOZZLE MAINTENANCE - Continued.

a. Removal.

NOTE

Proper gap must be maintained.

(1) Remove setscrew (8) and pull baffle (7) from block (3).

(2) Remove setscrew (2) and pull nozzle tube assembly (5) from block (3).

(3) Remove nozzle (6) and connector (4) from nozzle tube assembly (5).

(4) Remove o-ring (1) from block (3).

(5) Remove three screws (10), three lockwashers (11), and three flat washers (12) from block (3).

(6) Remove petal valve (9).

b. Inspection.

(1) Inspect threads for signs of stripping, damage, or corrosion.

(2) Inspect nozzle for clogs, burrs, and wear.

(3) Inspect fuel tube for bends and dents.

c. Cleaning.

WARNING

Cleaning solvent, Federal specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

(1) Clean all parts in cleaning solvent (item 11, Appendix E).

(2) Allow to dry.

d. Installation.

NOTE

Do not apply locking compound to tube threads at flare end.

(1) Apply locking compound (item 6, Appendix E) to threads.

(2) Install petal valve (9) to block (3) with three screws (10), three flat washers (12), and three lockwashers (11).

(3) Install o-ring (1) onto block (3).

(4) Install nozzle (6) and connector (4) to tube (5).

(5) Install baffle (7) onto tube (5) against the hex on tube (5).

(6) Install setscrew (8) into baffle (7).

(7) Install block (3) onto tube (5) and space 1.22 inches from baffle (7).

(8) Install setscrew (2) into block (3).

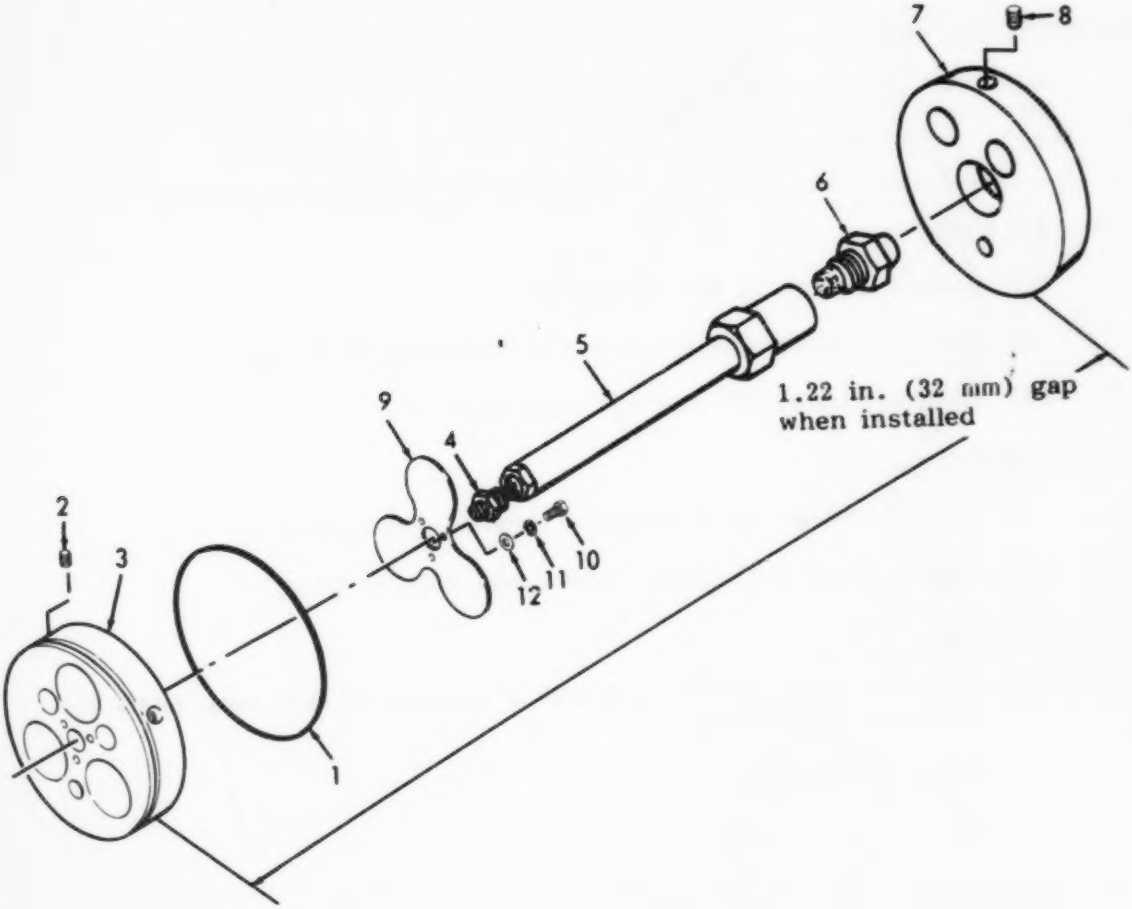

7
8
6
5
9
4
2
3
12
11
10
1
1.22 in. (32 mm) gap when installed

Figure 3-54. Nozzle, Removal/Installation.

3-40. COMBUSTION AIR HOSE MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Mild Soap (Item 10, Appendix E)

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Supply and return air ducts removed.

---

a. Removal.

(1) Loosen clamp (1) and clamp (3).

(2) Remove combustion air hose (2) from heat exchanger (4).

(3) Remove clamps (1) and (3) from hose (2).

b. Inspection.

(1) Inspect clamps for a stripped threads and corrosion.

(2) Inspect hose for cracks, holes, and deterioration.

c. Cleaning.

(1) Clean the hose by washing with a solution of mild soap (item 10, Appendix E) and water.

(2) Rinse thoroughly.

(3) Allow to dry.

d. Installation.

(1) Place clamps (1) and (3) on each end of hose (2).

(2) Install hose (2) on heat exchanger (4) and tighten clamps (1) and (3).

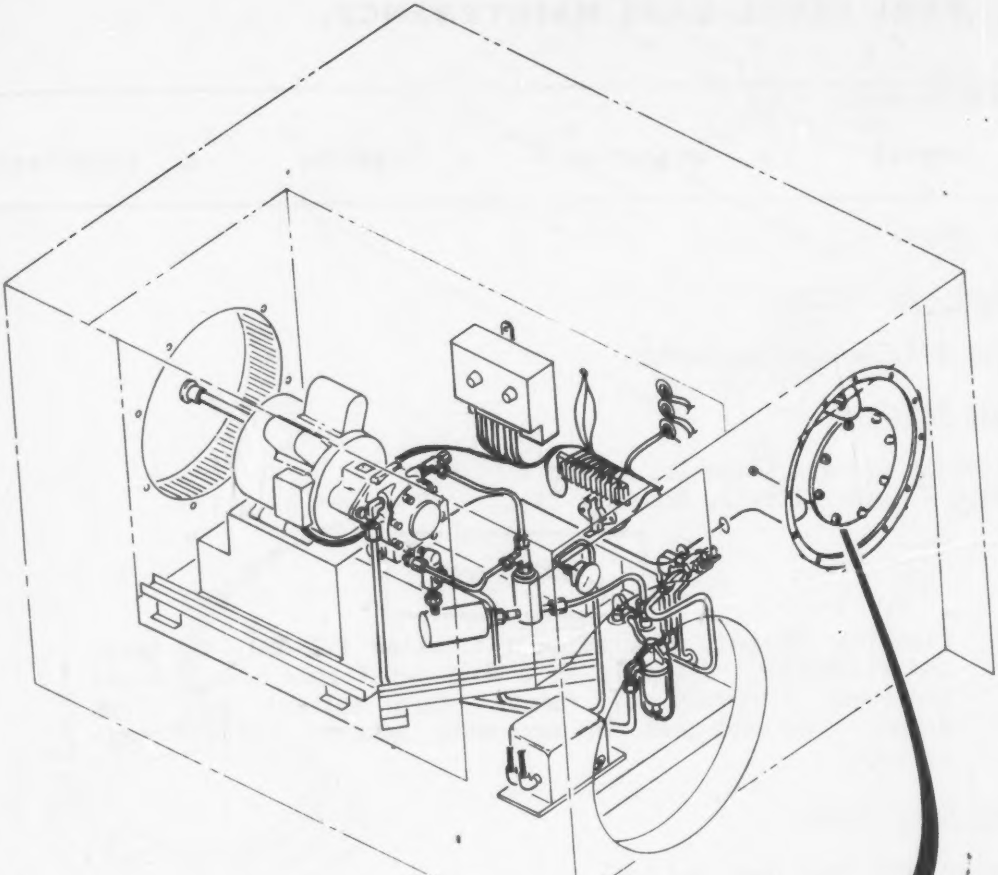


Figure 3-55. Combustion Air Hose, Removal/Installation.

3-41. FUEL LEVEL GAGE MAINTENANCE.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Cleaning Solvent (Item 11, Appendix E)
Glass Cleaner (Item 3, Appendix E)

WARNING

Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.

---

a. **Removal.**

(1) Remove four screws (1), four lockwashers (2), and four flat washers (3).

(2) Remove fuel level gage (4).

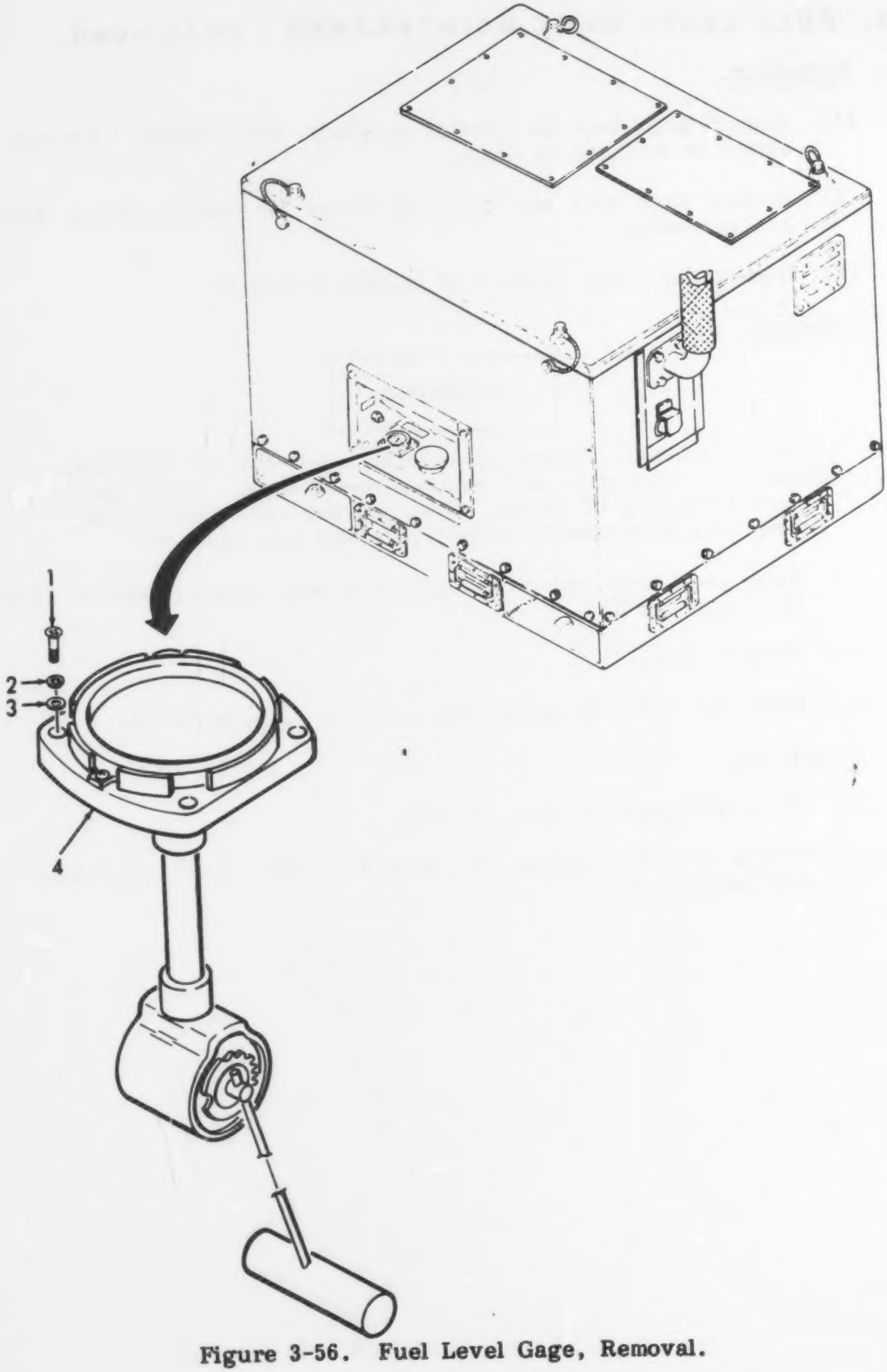


Figure 3-56. Fuel Level Gage, Removal.

3-41. FUEL LEVEL GAGE MAINTENANCE - Continued.

b. Inspection.

(1) Inspect gage face for cracks, moisture, and crazing. Be sure needle is attached to shaft.

(2) Inspect gage body and mounting flange for cracks, dents, holes, and corrosion.

(3) Inspect for loose damaged or missing hardware.

c. Cleaning.

WARNING

Cleaning solvent, Federal specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

(1) Wash gage body and mounting flange with cleaning solvent (item 11, Appendix E).

(2) Allow to dry.

(3) Clean the face with glass cleaner (item 3, Appendix E).

d. Installation.

(1) Place fuel gage (4) into position.

(2) Secure with four screws (1), four flat washers (3), and four lockwashers (2).

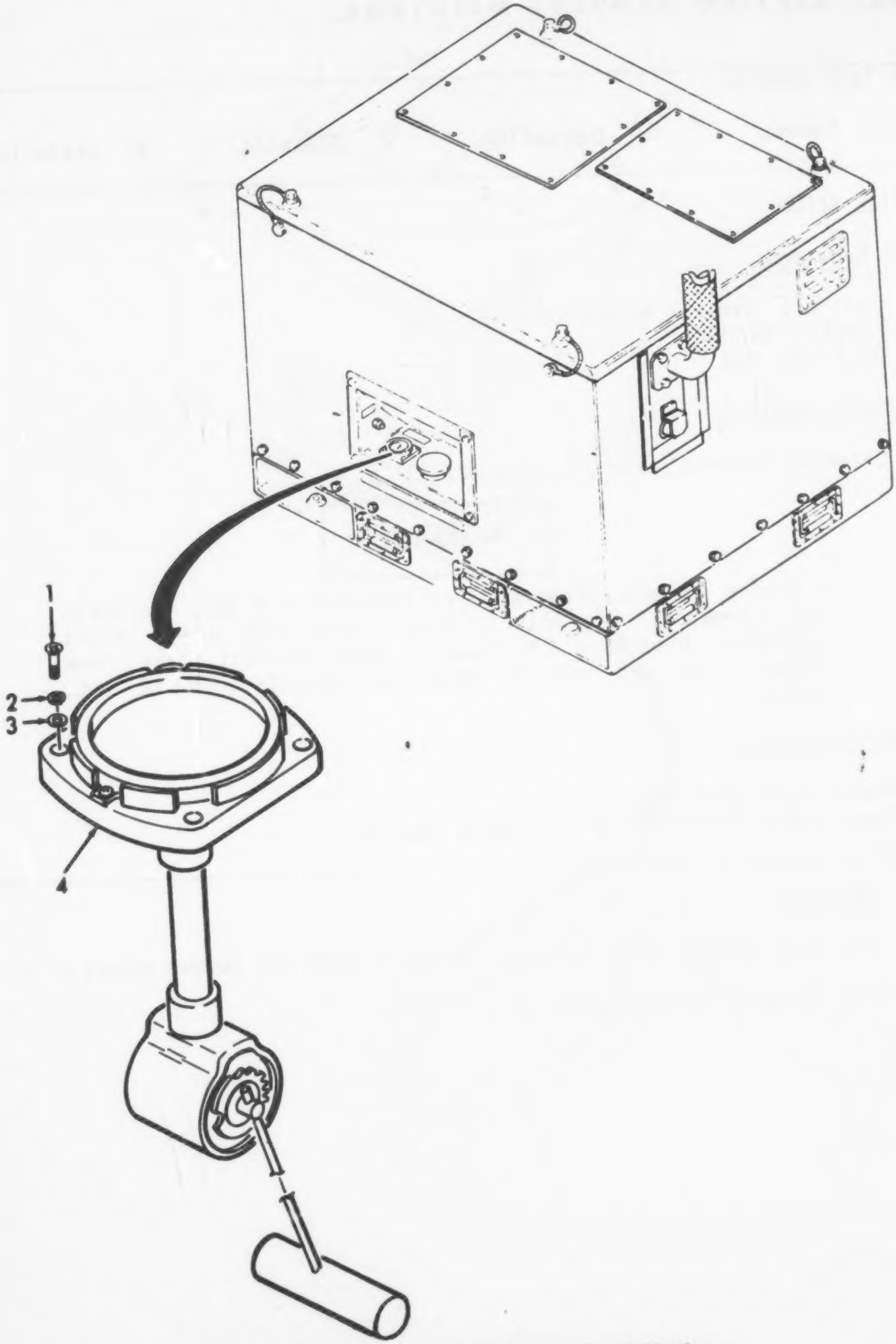


Figure 3-57. Fuel Level Gage, Installation.

3-42. LIFTING HANDLES MAINTENA.

This Task Covers:

a. Removal b. Inspection c. Cleaning d. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics
Electric Drill
Drill Bit Set

Materials Required:

Cleaning Solvent (Item 11, Appendix E)

WARNING

Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.

---

a. Removal.

(1) Use electric drill and size 30 bit to drill out twelve rivets (1).

(2) Remove lifting handle (2).

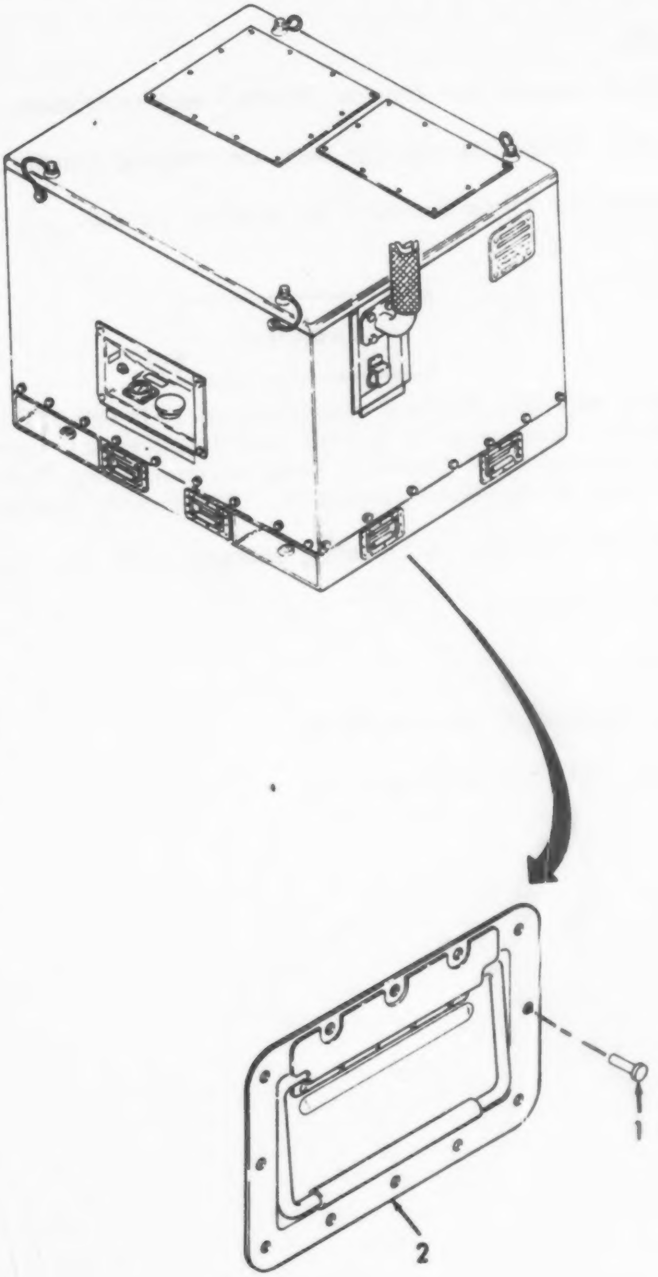


Figure 3-58. Lifting Handles, Removal.

3-42. LIFTING HANDLES MAINTENANCE - Continued.

b. Inspection.

(1) Inspect handle for cracks, burrs, and corrosion.

(2) Inspect lifting handle for bent or missing handle.

(3) Inspect for loose damaged or missing rivets.

c. Cleaning.

WARNING

Cleaning solvent, Federal specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

(1) Clean the handles in cleaning solvent (item 11, Appendix E).

(2) Allow to dry.

d. Installation.

(1) Place handle (2) into position.

(2) Secure with twelve rivets (1).

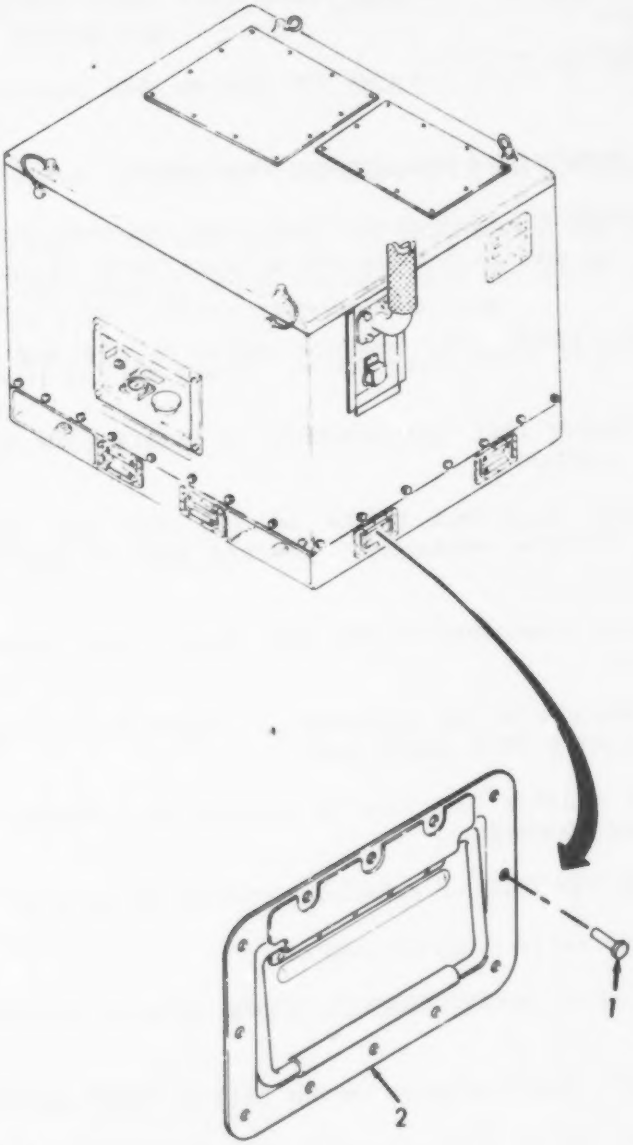


Figure 3-59. Lifting Handles, Installation.

Section VII. PREPARATION FOR STORAGE OR SHIPMENT

Para.

Preparation for Storage or Shipment............................3-43

3-43. PREPARATION FOR STORAGE OR SHIPMENT.

a. Shut down the heater unit by setting the OFF/VENT/HEAT switch (S1) to VENT. Allow the unit to operate for at least three minutes to aid in cooling.

b. Set the OFF/VENT/HEAT selector switch to OFF and disconnect power cable.

c. Raise the heater unit approximately 12 inches (255 mm) above ground level and block in position.

d. Remove drain plug from bottom of fuel tank and allow fuel to drain completely into a suitable container. Discard fuel in accordance with local regulations.

e. Place suitable container under fuel tank drain while performing the following procedures.

f. Prepare a mixture of the following: 1 quart P-9 preservative (item 7, Appendix E) to 9 quarts DF-2 diesel fuel.

g. Submerge a suitable fuel hose in mixture and connect opposite end of hose to external fuel connection.

h. Be sure OFF/VENT/HEAT selector switch is set to OFF.

i. Connect power cable to power source.

j. Set INTERNAL TANK/EXTERNAL TANK selector switch to EXTERNAL TANK position.

k. Set OFF/VENT/HEAT selector switch (S1) to VENT for 5 to 10 seconds.

l. Set OFF/VENT/HEAT selector switch (S1) to HEAT and then set OFF/ON switch (S7) to ON. Allow burner to operate for one minute.

m. After one minute, remove hose from preservative solution and let burner go out from fuel starvation. Audible alarm (EM1) should sound.

n. Set OFF/VENT/HEAT selector switch (S1) to OFF.

o. Install fuel tank drain plug.

p. Disconnect fuel hose from external fuel connection and install cap on fuel connector.

q. Disconnect power cable from power source. Wrap cable around duct stubs and secure in spring clip.

r. Disconnect return and supply air ducts. Stow in original shipping container.

s. Install duct covers on return and supply air duct stubs.

t. Remove exhaust pipe and stow in exhaust stack compartment.

u. If local authority directs, stack heater units not more than three high, and secure in position with stacking bolts and banding.

v. If heater unit will be stored, cover gage faces with tape to prevent pitting and abrasion.

CHAPTER 4

INTERMEDIATE DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

Section I. Troubleshooting
Section II. Maintenance Instructions

Section I. TROUBLESHOOTING

Para.
Introductory Information.........4-1
Symptom Index...................4-2
Troubleshooting................4-3

4-1. INTRODUCTORY INFORMATION.

a. The table lists the common malfunctions which you may find during the maintenance of the heater unit or its components. You should perform the tests/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunctions not listed or is not corrected by the listed corrective actions, notify your supervisor.

4-2. SYMPTOM INDEX.

Malfunction No.	Malfunction	Page
1	Centrifugal fan fails to start	4-1
2	Fuel pressure fails to rise (Heat Mode)	4-2
4	High fuel pressure	4-2
3	Low fuel pressure	4-2

4-3. TROUBLESHOOTING. (Refer to Table 4-1).

Table 4-1. Intermediate Direct Support Level Troubleshooting

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

---

1. CENTRIFUGAL FAN FAILS TO OPERATE.

If this condition exists, replace the motor (para 4-6).

best copy available

Table 4-1. Intermediate Direct Support Level Troubleshooting - Continued

---

MALFUNCTION
    TEST OR INSPECTION
        CORRECTIVE ACTION

---

2. FUEL PRESSURE FAILS TO RISE (HEAT MODE).

Step 1. Check for inoperable motor.

If motor does not operate, test motor (para 4-6).

If motor operates, proceed to step 2.

Step 2. Check for damaged coupler.

If coupler is damaged, replace coupler (para 4-6).

3. LOW FUEL PRESSURE

If this condition exists, adjust fuel pump in accordance with table 2-4.

If fuel pressure cannot be adjusted, replace fuel pump (para 4-6).

4. HIGH FUEL PRESSURE.

If this condition exists, adjust fuel pump in accordance with table 2-4.

If fuel pressure cannot be adjusted, replace fuel pump (para 4-6).

Section II. MAINTENANCE PROCEDURES

Para.

Cabinet Assembly Maintenance.....4-4
Control Panel Maintenance........4-5
Blower, Pump, and Motor Assembly Maintenance...............4-6
Skid Maintenance...............4-7

4-4. CABINET ASSEMBLY MAINTENANCE.

This Task Covers:

a. Cleaning b. Inspection c. Repair of Access Door
d. Painting

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Abrasive Paper (Item 5, Appendix E)
Cleaning Solvent (Item 11, Appendix E)
Masking Tape (Item 12, Appendix E)
Paint (Item 4, Appendix E)
Primer (Item 8, Appendix E)
Primer (Item 9, Appendix E)

WARNING

- Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.
- Paints are flammable. Use in a well-ventilated area and remove all possible sources of ignition to prevent potential injury.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.

4-4. CABINET ASSEMBLY MAINTENANCE - Continued.

a. Cleaning.

WARNING

Cleaning solvent, Federal specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

(1) Clean the exterior of the heater unit with cleaning solvent (item 11, Appendix E). Pay particular attention to any grease, oil, or other stains.

(2) Allow to dry.

b. Inspection.

(1) Inspect access door as follows:

(a) Inspect door for dents, holes, cracks, and corrosion.

(b) Inspect door for damaged or missing quarter-turn fasteners.

(c) Inspect door for damaged, deteriorated, or missing gaskets.

(2) Inspect fresh air damper as follows:

(a) Inspect damper for broken or missing chain and chain for corrosion or burrs.

(b) Inspect hinges for loose or missing rivets, damage, dents, and corrosion.

(c) Inspect damper for loose, damaged, or missing hardware.

(d) Inspect damper for dents, burrs, cracks, or corrosion.

(3) Inspect access door as follows:

(a) Inspect door for dents, holes, cracks, and corrosion.

(b) Inspect door for loose, missing, or damaged hardware.

(4) Inspect duct cover as follows:

(a) Inspect cable for secure mounting, burrs, breaks, and corrosion.

(b) Inspect cover for cracks, holes, and deterioration.

(5) Inspect cabinet as follows:

(a) Inspect interior and exterior for cracks, dents, holes, and corrosion.

(b) Inspect for loose, missing, or damaged hardware.

c. Repair. Repair is limited to replacement of access door or duct cover if damaged. If other parts of the cabinet are found defective during inspection, notify intermediate general support maintenance.

d. Painting.

NOTE

Air Force personnel should use appropriate T.O.

(1) Aluminum Surfaces:

(a) Use abrasive paper (item 5, Appendix E).

(b) Clean and treat per TM 43-0139.

(c) Prime with one coat of primer per MIL-P-53022.

(d) Finish with one coat per MIL-C-46168, Type II, Chemical Agent Resistant, Green 383.

(2) Steel Surfaces:

(a) Use abrasive paper (item 5, Appendix E).

(b) Clean and treat per TM 43-0139.

(c) Prime with one coat of primer per MIL-P-52192.

(d) Finish with one coat per MIL-C-46168, Type II, Chemical Agent Resistant, Green 383.

(3) Camouflage. If heater unit is to be camouflaged, proceed as follows:

(a) Use masking (item 12, Appendix E) and mask off pattern as shown. (Refer to Figure 4-1).

(b) Paint, using paint (item 4, Appendix E) in colors shown for conditions.

NO.	STANDARD	DESERT	WINTER/SNOW
1 2 3	Black Green 383 Brown 383	Tan 686 Tan 686 Tan 686	Black White Brown 383

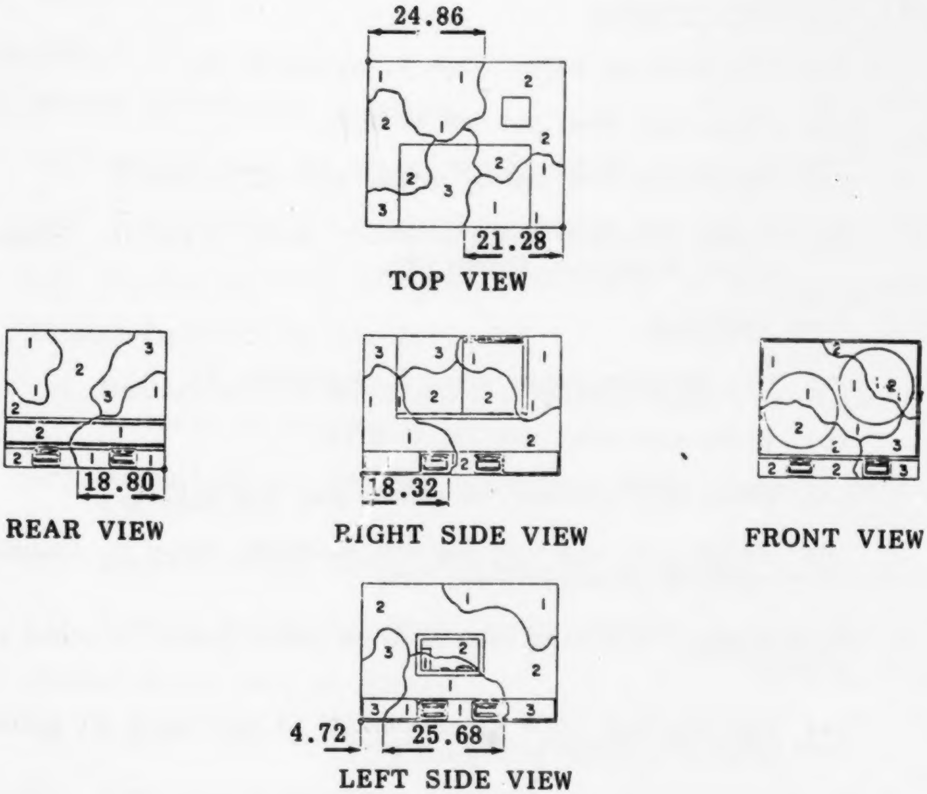

24.86
21.28
TOP VIEW
18.80
REAR VIEW
18.32
RIGHT SIDE VIEW
FRONT VIEW
4.72
25.68
LEFT SIDE VIEW

Figure 4-1. Camouflage Paint Pattern.

4-5. CONTROL PANEL MAINTENANCE.

This Task Covers:

a. Cleaning b. Inspection c. Cleaning d. Repair
e. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Abrasive Paper (Item 5, Appendix E)
Cleaning Solvent (Item 11, Appendix E)
Paint (Item 4, Appendix E)
Primer (Item 8, Appendix E)

WARNING

- Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.
- Paints are flammable. Use in a well-ventilated area and remove all possible sources of ignition to prevent potential injury.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
OFF/VENT/HEAT switch (S1) removed (para 3-14a).
Fuel pressure gage removed (para 3-15a).
Hour meter removed (para 3-16a).
Safety relay (K8) removed (para 3-17a).
Audible alarm (EM1) removed (para 3-18a).
Circuit breaker (CB1) removed (para 3-19a).
ON/OFF toggle switch (S7) removed para (3-20a).
Rectifier removed (para 3-21a).
INTERNAL TANK/EXTERNAL TANK selector removed (para 3-22a).

4-5. CONTROL PANEL MAINTENANCE - Continued.

a. Removal.

(1) Remove six screws (4), six lockwashers (3), and six flat washers (2).

(2) Remove control panel (1).

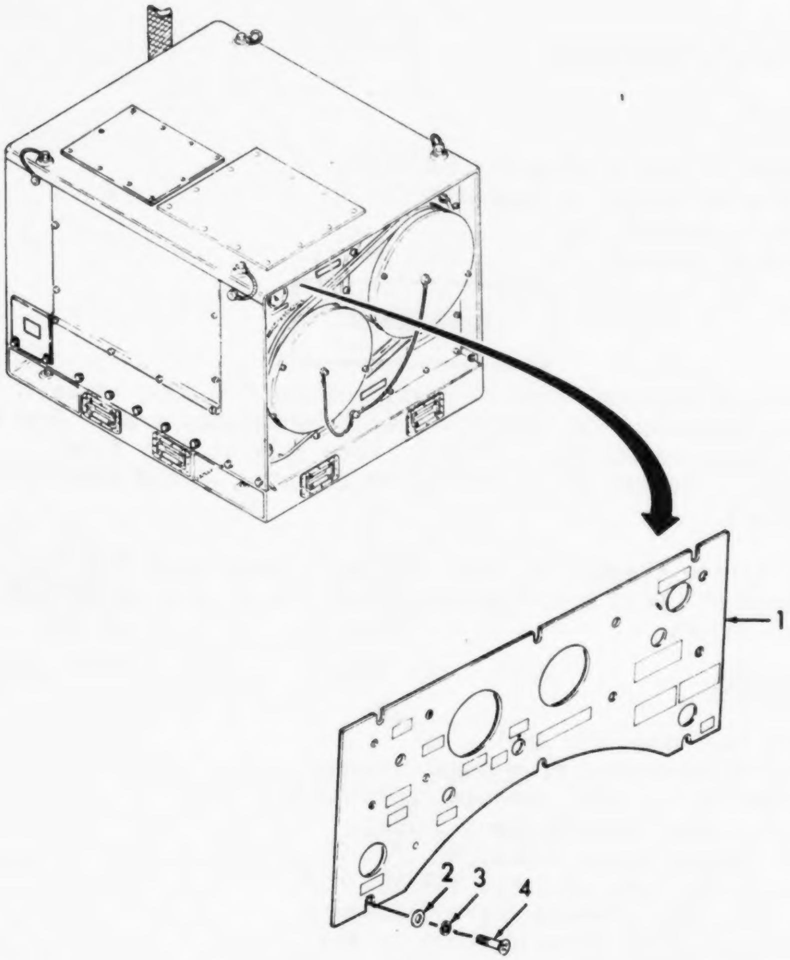


Figure 4-2. Control Panel, Removal.

b. Inspection.

(1) Inspect for missing or damaged hardware.

(2) Inspect for cracks, holes, burrs, and corrosion.

c. Cleaning.

WARNING

Cleaning solvent, Federal specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

(1) Clean control panel with cleaning solvent (item 11, Appendix E).

(2) Allow to dry.

d. Repair. Repair is limited to refinishing as follows:

(1) Use abrasive paper (item 5, Appendix E).

(2) Clean and treat per TM 43-0139, or appropriate Air Force T.O.

(3) Prime with one coat of primer per MIL-P-53022.

(4) Finish with one coat per MIL-C-46168, Type II, Chemical Agent Resistant, Green 383.

4-5. CONTROL PANEL MAINTENANCE - Continued.

e. Installation.

(1) Place control panel (1) into position.

(2) Install six flat washers (2), six lockwashers (3), and six screws (4).

(3) Install INTERNAL TANK/EXTERNAL TANK per para 3-22d.

(4) Install rectifier per para 3-21e.

(5) Install ON/OFF toggle switch S7 per para 3-20d.

(6) Install circuit breaker (CB1) per para 3-19e.

(7) Install audible alarm (EM1) per para 3-18d.

(8) Install combustion control relay (K8) per para 3-17e.

(9) Install hourmeter per para 3-16d.

(10) Install fuel pressure gage per para 3-15d.

(11) Install OFF/VENT/HEAT switch (S1) per para 3-14e.

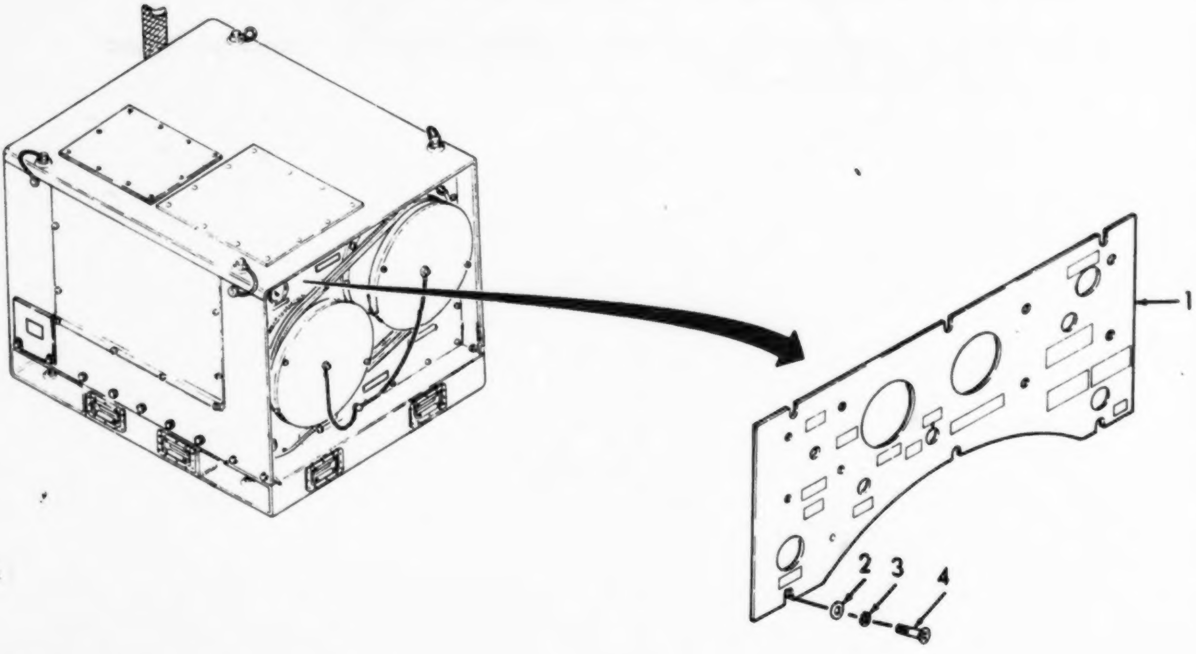


Figure 4-3. Control Panel, Installation.

4-6. BLOWER, PUMP, AND MOTOR ASSEMBLY MAINTENANCE.

This Task Covers:

a. Removal
b. Inspection
c. Cleaning
d. Motor Testing
e. Motor Disassembly/Repair
f. Assembly
g. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics
Multimeter

Materials Required:

Cleaning Solvent (Item 11, Appendix E)

Trichloroethane (Item 14, Appendix E)

WARNING

- Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.
- Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Air filters removed (para 3-10a).
Solenoid valves removed (para 3-34a).
Fuel oil filter removed (para 3-35a).

4-6. BLOWER, PUMP, AND MOTOR ASSEMBLY MAINTENANCE - Continued.

a. Removal.

(1) Tag and disconnect all wiring to motor (1).

(2) Tag and disconnect all tubing attached to fuel pump (4).

(3) Remove seven screws (16), seven lockwashers (15), seven flat washers (14) attaching venturi ring (13) to cabinet.

(4) Remove six self-locking nuts (10), six flat washers (9), six screws (7), and six flat washers (8).

(5) Remove motor (1) with venturi ring (13), fuel pump (4), and blower (12) attached.

(6) Loosen two setscrews (11) and remove blower wheel (12) and venturi ring (13), from motor (1).

(7) Remove two screws (6), two lockwashers (5), and fuel pump (4).

(8) Remove pin (3) and coupling (2) from motor (1).

b. Inspection.

(1) Inspect blower wheel for cracks, missing or damaged blades, and corrosion.

(2) Inspect fuel pump for cracked or leaking housing, broken or bent shaft. Check shaft end for rounded edges.

(3) Inspect for damaged or missing hardware.

(4) Inspect motor for burned wiring, bent shaft, and damaged housing.

c. Cleaning.

WARNING

Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

(1) Clean blower wheel and fuel pump with cleaning solvent (item 11, Appendix E).

(2) Allow to dry.

WARNING

Trichloroethane, Federal Specification O-T-620, is toxic to skin, eyes, and respiratory tract. Skin and eye protection are required. Use only in a well-ventilated area.

(3) Clean motor with trichloroethane (item 14, Appendix E).

(4) Allow to dry.

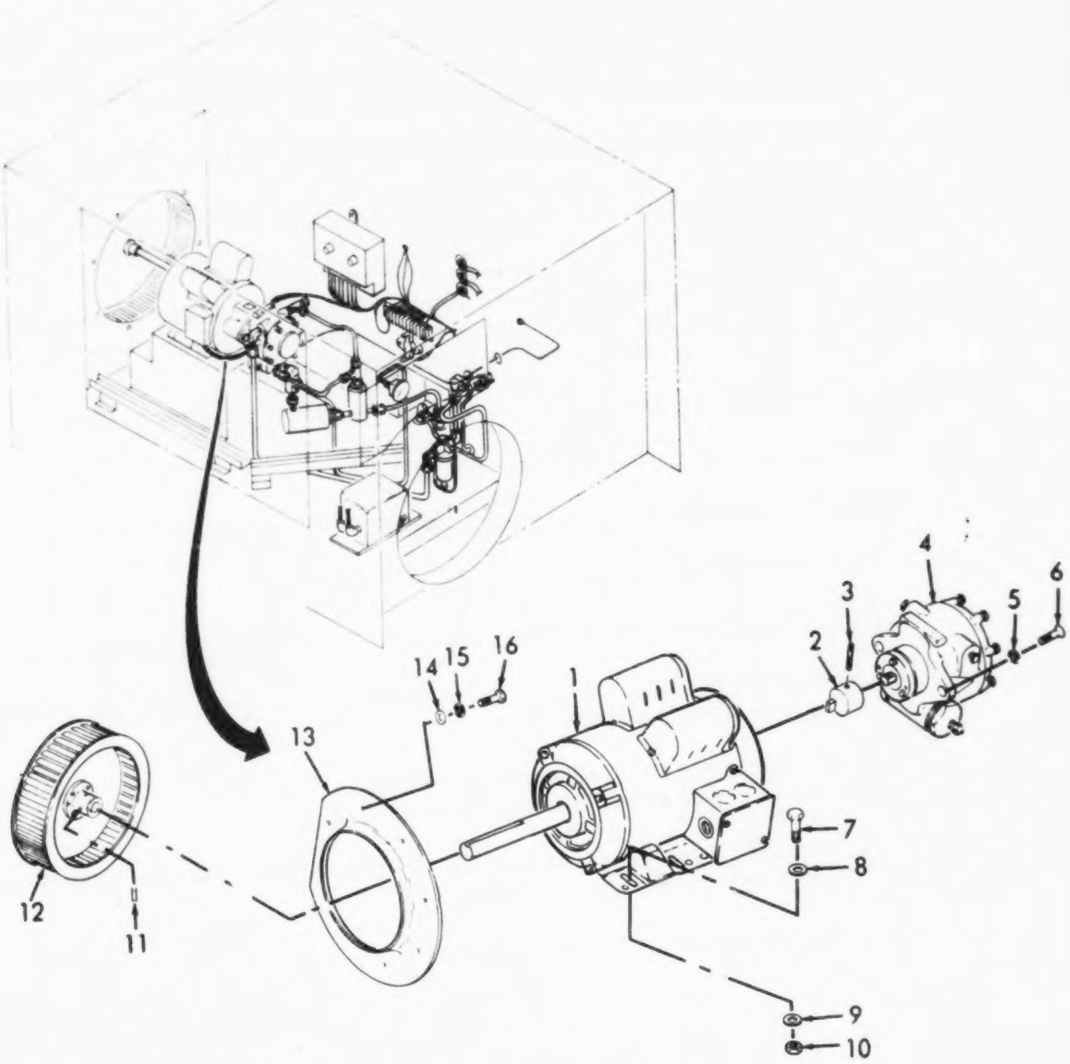


Figure 4-4. Blower, Pump, and Motor Assembly, Removal.

4-6. BLOWER, PUMP, AND MOTOR ASSEMBLY MAINTENANCE - Continued.

d. Motor Testing.

(1) Rotate motor shaft by hand to check for freedom of rotation.

(2) Use a multimeter and check for open windings.

(3) Use a multimeter and check start and run capacitors.

e. Motor Disassembly/Repair.

(1) Remove two screws (23), cover (24), two screws (22), and conduit box (25), and ground screw (26).

(2) Remove two screws (15) and cover (16).

WARNING

Discharge capacitors using a flat tip plastic handle screwdriver across terminals prior to disconnecting wires. Failure to do so can cause an electrical shock.

(3) Tag and disconnect wiring and remove start capacitor (27).

(4) Remove two screws (17) and cover (18).

(5) Tag and disconnect wiring and remove run capacitor (28).

(6) Remove key (8).

(7) Remove four nuts (21), four screws (1), and four washers (2).

(8) Remove endbell (3), spring (4), bearing (5), and fan (6), from shaft and rotor assembly (9).

(9) Remove endbell (20), stationary switch (19), shim (13), bearing (12), rotary switch (11), and spacer (10).

(10) Remove shaft and rotor assembly (9) from frame/stator and base assembly (14) and remove baffle (7).

(11) Replace defective parts as required.

f. Reassembly.

(1) Install baffle (7), shaft and rotor assembly (9) into frame/stator and base assembly (14).

(2) Install spacer (10), rotary switch (11), bearing (12), shim (13), stationary switch (19), and endbell (20).

(3) Install fan (6), bearing (5), spring (4), and endbell (3).

(4) Install four washers (2) and four screws (1) using care to line up endbells, baffles, and frame holes. Install four nuts (21).

(5) Install key (8) into keyway.

(6) Connect wiring and place run capacitor into position in cover (18).

(7) Install cover (18) and secure with two screws (17).

(8) Connect wiring and place start capacitor into position in cover (16).

(9) Install cover (16) and secure with two screws (15).

(10) Install conduit box (25) and secure with two screws (22).

(11) Install ground wire and secure with screw (26).

(12) Install cover (24) and secure with two screws (23).

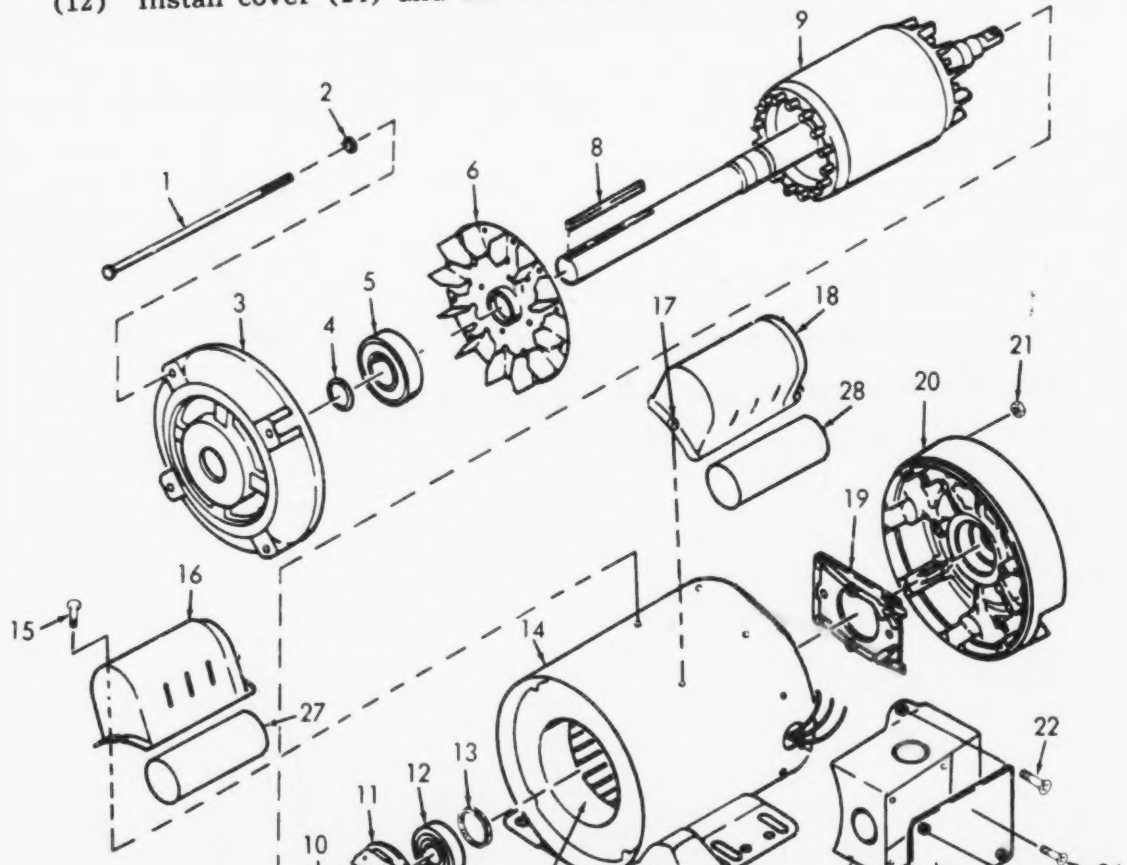


Figure 4-5. Motor Repair, Reassembly.

4-6. BLOWER, PUMP, AND MOTOR ASSEMBLY MAINTENANCE - Continued.

g. Installation.

(1) Install coupling (2) to fuel pump (4) and secure with pin (3).

(2) Install fuel pump (4) to motor (1) and secure with two lockwashers (5), and two screws (6).

(3) Place venturi ring (13) over shaft of motor (1).

(4) Install blower wheel (12) onto motor (1) and secure with two setscrews (11).

(5) Place motor (1) with attached venturi ring (13) into position in cabinet.

(6) Install seven flat washers (14), seven lockwashers (15), and seven screws (16) to secure venturi ring (13).

(7) Install six flat washers (8), six screws (7), six flat washers (9), and six self-locking nuts (10).

(8) Connect wiring to motor (1) per tagged identification.

(9) Connect tubing to fuel pump as tagged.

(10) Install fuel oil filter (para 3-35d).

(11) Install solenoid valves (para 3-34d).

(12) Install air filters and access door (para 3-10d).

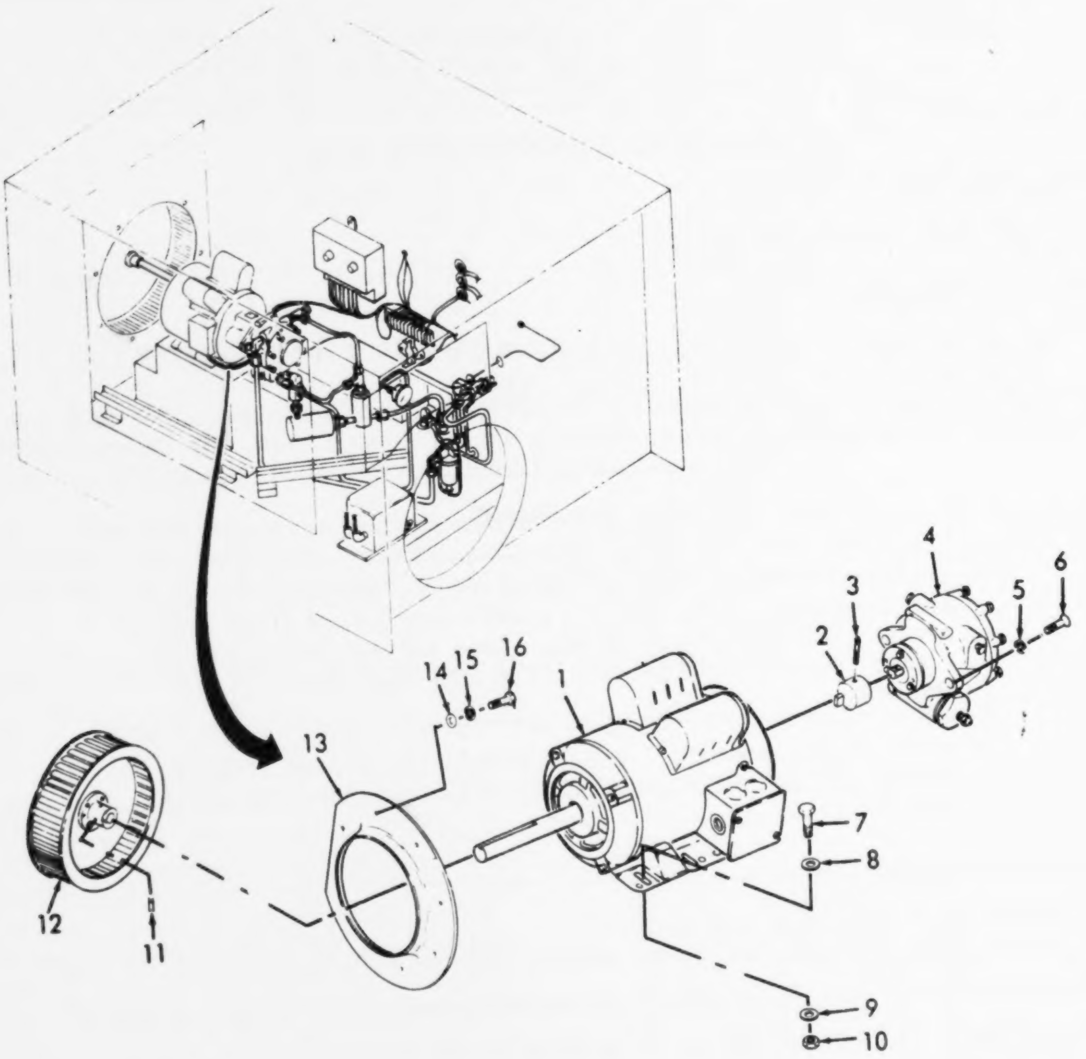

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Figure 4-6. Blower, Pump, and Motor Assembly, Installation.

4-7. SKID MAINTENANCE.

This Task Covers:

a. Repair

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Abrasive Paper (Item 5, Appendix E
Cleaning Solvent (Item 11, Appendix E)
Paint (Item 4, Appendix E)
Primer (Item 8, Appendix E)

WARNING

- Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.
- Paints are flammable. Use in a well-ventilated area and remove all possible sources of ignition to prevent potential injury.

Equipment Conditions:

Heater unit shut down and cool.
Power cable removed from power source.

---

a. Repair. Repair is limited to refinishing as follows:

(1) Use abrasive paper (item 5, Appendix E) to smooth out rough areas.

(2) Clean and treat per TM 43-0139.

(3) Prime with one coat of primer (item 8, Appendix E) per MIL-P-53022.

(4) Finish with one coat of paint (item 4, Appendix E) per MIL-C--46168, Type II, Chemical Agent Resistant, Green 383.

CHAPTER 5

INTERMEDIATE GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

Section I. Troubleshooting
Section II. Maintenance Instructions

Section I. TROUBLESHOOTING

Para.

Introductory Information.........5-1
Troubleshooting................5-2

5-1. INTRODUCTORY INFORMATION.

a. The table lists the common malfunctions which you may find during the maintenance of the heater unit or its components. You should perform the tests/inspections and corrective actions in the order listed.

b. This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by the listed corrective actions, notify your supervisor.

5-2. TROUBLESHOOTING. (Refer to Table 5-1).

Table 5-1. Intermediate General Support Level Troubleshooting

MALFUNCTION
    TEST OR INSPECTION
        CORRECTIVE ACTION

1. HEAT EXCHANGER IS DEFECTIVE.

Replace heat exchanger if defective (paragraph 5-4).

Section II. MAINTENANCE INSTRUCTIONS

Para.

Cabinet Assembly Maintenance.....5-3
Heat Exchanger Maintenance.....5-4
Fuel Tank Maintenance..........5-5

5-3. CABINET ASSEMBLY AND SKID MAINTENANCE.

This Task Covers:

a. Removal b. Cleaning c. Inspection b. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Adhesive, Silastic (Item 1, Appendix E)
Bristle Brush (Item 2, Appendix E)
Cleaning Solvent (Item 11, Appendix E)

WARNING

Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

Equipment Conditions:

Heater unit shut down and cool.
Fuel tank empty.
Power cable disconnected from power source.
Gas cap removed.
Air filters removed (para 3-10a).
Exhaust pipe removed (para 3-11a).
Duct assemblies removed (para 3-12a).
Control panel removed (para 4-5a).
Transformer removed (para 3-26a).
High temperature safety thermostat removed (para 3-27a).
Heater temperature controller removed (para 3-28a).
Power cable assembly removed (para 3-29a).
High tension cable assembly removed (para 3-30a).
Discharge temperature thermostat removed (para 3-31a).
Return temperature thermostat removed (para 3-32a).
Solenoid valves removed (para 3-34a).
Fuel oil filter removed (para 3-35a).
Sightglass removed (para 3-36a).
Flame detector removed (para 3-37a).
Electrodes removed (para 3-38a).
Fuel burner nozzle removed (para 3-39a).
Combustion air hose removed (para 3-40a).
Fuel level gage removed (para 3-41a).
Lower access door removed (para 2-6c).

Blower, pump, and motor assembly removed (para 4-6a).
Heat exchanger removed (para 5-4a).

5-3. CABINET ASSEMBLY AND SKID MAINTENANCE - Continued.

a. Removal.

(1) Remove thirty-one screws (5), thirty-one lockwashers (6), and thirty-one flat washers (7).

(2) Remove screw (4), lockwasher (3), flat washer (2), and duct cover assemblies (1).

(3) Remove stacking screw (10) from top hole and screw into side holes.

(4) Install 3/8-16 threaded lifting eye (11) in top four stacking screw holes.

(5) Attach a sling, capable of lifting 225 lb (101.3 kg) to each lifting eye (11).

NOTE

Silastic adhesive is used around fuel level gage hole. Use a flat tip blade screwdriver and pry cabinet assembly loose from fuel tank.

(6) Attach a lifting device capable of lifting 225 lb (101.3 kg) and remove cabinet assembly (8) from skid (9).

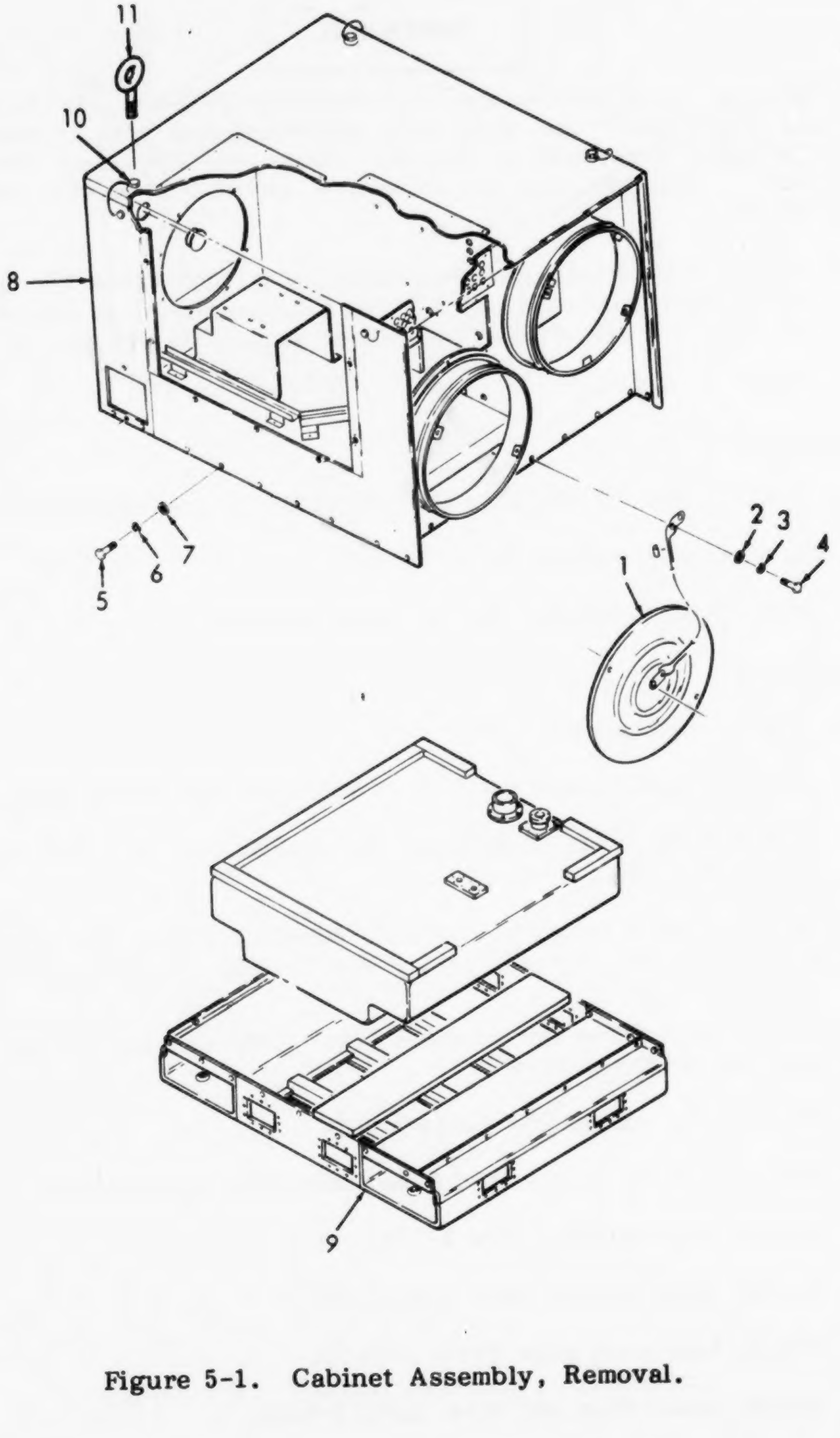
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Figure 5-1. Cabinet Assembly, Removal.

5-3. CABINET ASSEMBLY AND SKID MAINTENANCE - Continued.

b. Cleaning.

WARNING

Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

(1) Clean cabinet and skid with cleaning solvent (item 11, Appendix E) and a medium bristle brush (item 2, Appendix E) to remove all traces of soot and dirt. Clean fuel level gage hole area on fuel tank.

(2) Allow to dry.

c. Inspection.

(1) Inspect cabinet and skid for corrosion, cracks and dents.

(2) Inspect duct covers for cracks.

(3) Inspect all fasteners for deformed threads.

d. Installation.

(1) Remove lifting eyes (11).

(2) Install stacking screw (1) from side hole and screw into top hole.

(3) Install duct cover assemblies (1), lockwasher (3), flat washer (2), and screw (4).

(4) Apply a small amount of silastic adhesive around the fuel level gage hole area on fuel tank. Place cabinet (8) into position on skid (9).

(5) Install thirty-one flat washers (7), thirty-one lockwashers (6), and thirty-one screws (5).

(6) Install heat exchanger (para 5-4c).

(7) Install blower, pump, and motor assembly (para 4-6h).

(8) Install duct covers (para 3-12e).

(9) Install lower access door (para 2-6c).

(10) Install fuel level gage (para 3-41d).

(11) Install combustion air hose (para 3-40d).

(12) Install fuel nozzle (para 3-39d).

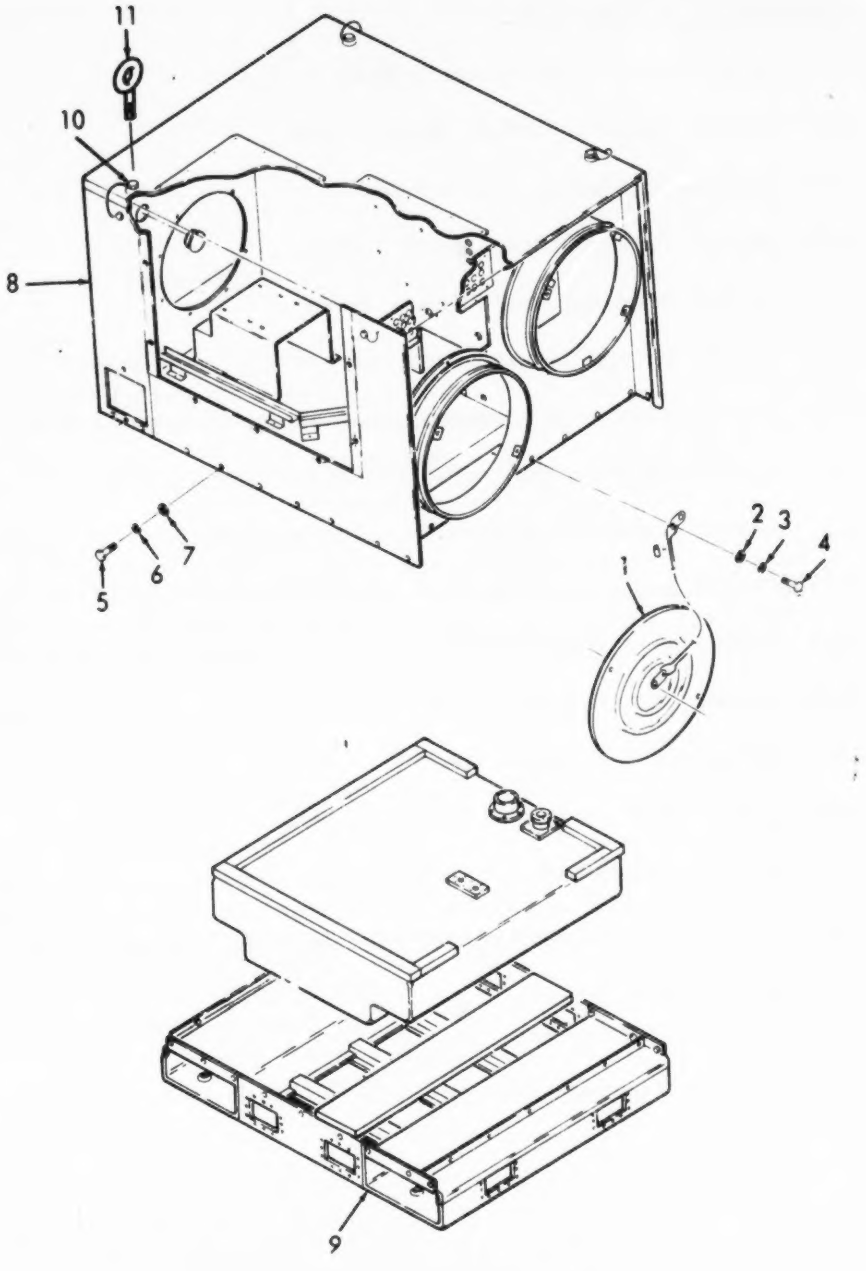
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Figure 5-2. Cabinet Assembly, Installation.

5-3. CABINET ASSEMBLY AND SKID MAINTENANCE - Continued.

d. Installation - Continued.

(13) Install electrodes (para 3-38d).

(14) Install flame detector (para 3-37d).

(15) Install sightglass (para 3-36d).

(16) Install fuel oil filter (para 3-35e).

(17) Install solenoid valve (para 3-34e).

(18) Install return temperature thermostat (para 3-32e).

(19) Install discharge temperature thermostat (para 3-31e).

(20) Install high tension cable assembly (para 3-30e).

(21) Install power cable assembly (para 3-29d).

(22) Install heater temperature controller (para 3-28d).

(23) Install high temperature safety thermostat (para 3-27e).

(24) Install transformer (para 3-26e).

(25) Install control panel (para 4-5e).

(26) Install duct assembly (para 3-12e).

(27) Install exhaust pipe (para 3-11d).

(28) Install air filters and access door (para 3-10d).

(29) Install gas cap.

5-4. HEAT EXCHANGER MAINTENANCE.

This Task Covers:

a. Removal b. Cleaning c. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Cleaning Solvent (Item 11, Appendix E)

WARNING

Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Air filters removed (para 3-10a).
Exhaust pipe removed (para 3-11a).
Duct assemblies removed (para 3-12a).
High temperature safety thermostat removed (para 3-27a).
Discharge temperature thermostat removed (para 3-31a).
Sightglass removed (para 3-36a).
Flame detector removed (para 3-37a).
Burner assembly removed (para 3-38a).
Combustion air hose removed (para 3-41a).

5-4. HEAT EXCHANGER MAINTENANCE - Continued.

a. Removal.

(1) Remove nut (2).

(2) Remove four screws (6), four lockwashers (5), four flat washers (4), and sealing plate (3).

(3) Remove cap nut (19), two nuts (16), two lockwashers (17), and two flat washers (18).

(4) Remove two nuts (14), two lockwashers (13), two flat washers (12), and rod (15).

(5) Remove nut (7), nut (9), rod (10), hose (11), and perforated plate (8) from air intake tube of heat exchanger.

(6) Repeat for other two rods.

(7) Slide heat exchanger (20) out of heater unit.

(8) Remove nut (21) and sightglass tube (1) from rear of heat exchanger (20).

b. Cleaning.

WARNING

Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

(1) Clean heat exchanger with cleaning solvent (item 11, Appendix E).

(2) Allow to dry.

c. Installation.

(1) Install sightglass tube (1) and nut (21) to rear of heat exchanger (20).

(2) Slide heat exchanger (20) into heater unit. Be sure sightglass tube fits into hole in heater unit.

(3) Install two nuts (14), two flat washers (13), and two lockwashers (12) to rod (15).

(4) Install two flat washers (18), two lockwashers (17), two nuts (16), and cap nut (19).

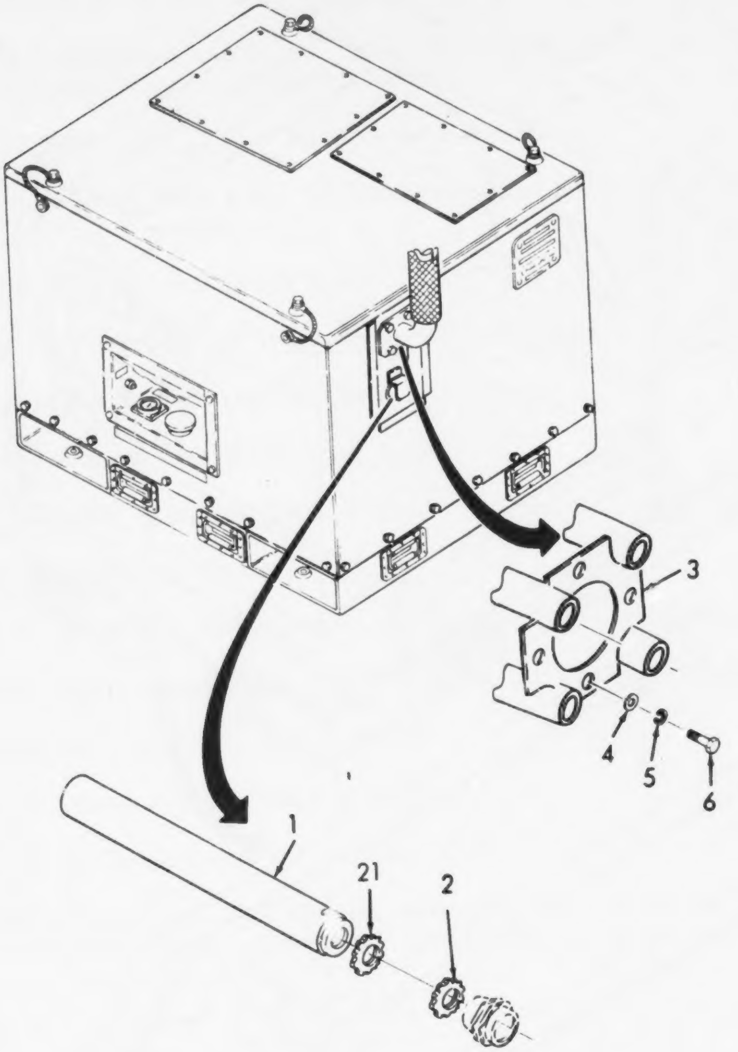

Figure 5-3. Heat Exchanger, Removal/Installation (Sheet 1 of 2).

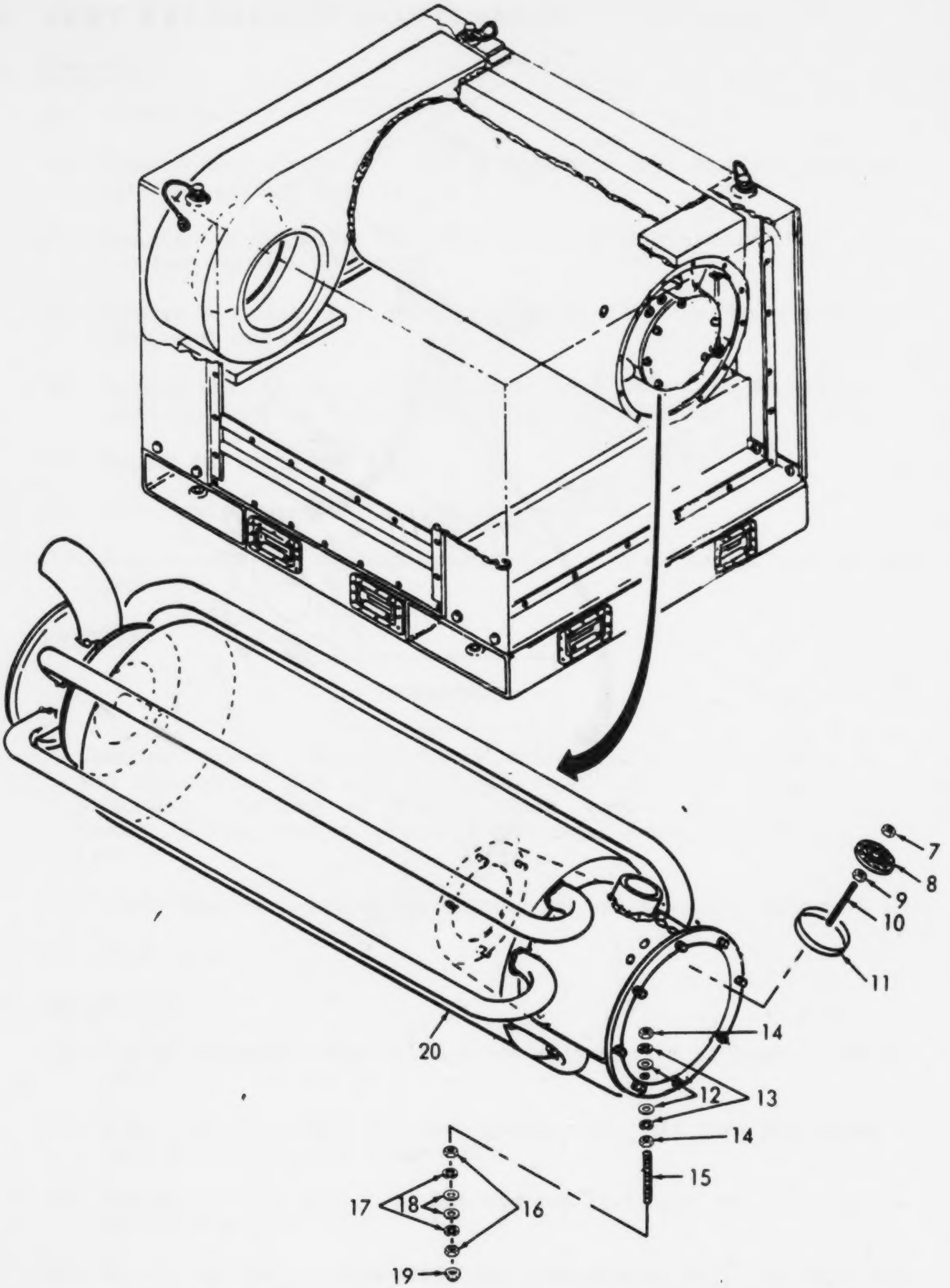
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Figure 5-3. Heat Exchanger, Removal/Installation (Sheet 2 of 2).

(5) Repeat for other two rods and adjust nuts and rods to center heat exchanger in heater unit opening.

(6) Install perforated plate (8), hose (11), rod (10), nut (7), and nut (9) into intake tube of heat exchanger (20).

(7) Install other nut (2) on outside of heater unit.

(8) Install sealing plate (3), four flat washers (4), four lockwashers (5), and four screws (6).

(9) Install duct covers (para 4-4f).

(10) Install combustion air hose (para 3-40d).

(11) Install fuel burner nozzle (para 3-39d).

(12) Install burner assembly (para 3-38d).

(13) Install flame detector (para 3-37d).

(14) Install sightglass (para 3-36d).

(15) Install discharge temperature thermostat (para 3-31e).

(16) Install high temperature safety thermostat (para 3-27e).

(17) Install duct assembly (para 3-12e).

(18) Install exhaust pipe (para 3-11d).

(19) Install air filters and access door (para 3-10d).

d. Carbon Monoxide Test. A carbon monoxide test must be conducted at 1000 hour operating intervals. Check for the presence of carbon monoxide as follows:

CAUTION

Follow the testing procedures carefully to avoid getting a false reading.

(1) Wrap a 24-inch length of 1/8-inch I.D. tubing with a soft shop towel for the full 24 inches. Wrap tightly and secure in place with string.

(2) Saturate the towel with cold water immediately before taking the sample. Do not allow water to enter the tubing.

(3) Purge tubing of fresh air by placing tubing in a heated air stream.

(4) Attach one end of the tubing to a carbon monoxide tester (4, Section III of MAC) and the other end into the ventilating air stream after the heater reaches a stabilized temperature of at least 100°F.

5-4. HEAT EXCHANGER MAINTENANCE - Continued.

d. Carbon Monoxide Testing - Continued.

(5) Draw a sample of ventilating air according to the procedures of the carbon monoxide tester being used.

(6) Replace the heat exchanger if carbon monoxide in the ventilating air stream is in excess of 0.005 percent or 50 parts per million.

5-5. FUEL TANK MAINTENANCE.

This Task Covers:

a. Removal
b. Cleaning
c. Installation

INITIAL SETUP:

Tools Required:

Tool Kit, General Mechanics

Materials Required:

Cleaning Solvent (Item 11, Appendix E)

WARNING

Cleaning solvent, Federal Specification P-D-68Q, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

Equipment Conditions:

Heater unit shut down and cool.
Power cable disconnected from power source.
Exhaust pipes removed from storage compartment (para 2-6).
Duct assemblies removed (para 3-12a).
Fuel level gage removed (para 3-41a).
Duct covers removed (para 5-3).
Cabinet assembly and skid removed (para 5-3).

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a. Removal.

(1) Lift fuel tank (1) from skid (2).

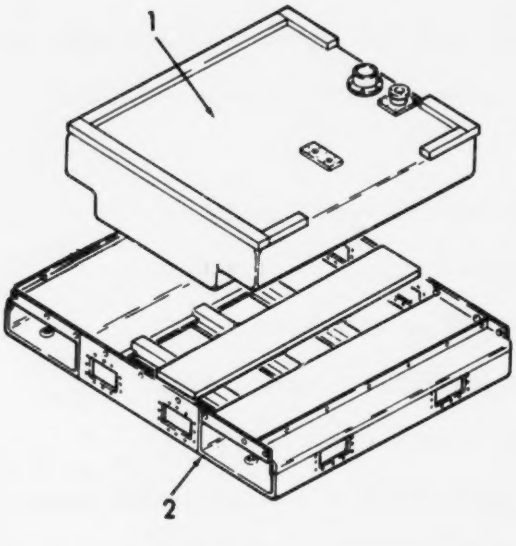


Figure 5-4. Fuel Tank, Removal.

5-5. FUEL TANK MAINTENANCE - Continued.

b. Cleaning.

WARNING

Cleaning solvent, Federal Specification P-D-680, is toxic and flammable. Use only in a well-ventilated area. Avoid prolonged breathing of fumes. Keep solvent away from flames. Do not use in excessive amounts. Avoid skin contact.

(1) Clean fuel tank with cleaning solvent (item 11, Appendix E) and a medium bristle brush (item 2, Appendix E) to remove all traces of soot and dirt.

(2) Allow to dry.

c. Inspection.

(1) Inspect fuel tank for signs of deterioration or fuel leakage.

(2) Replace fuel tank if any defects are found.

d. Installation.

(1) Install fuel tank (1) onto skid (2).

(2) Install cabinet assembly (para 5-3).

(3) Connect fuel lines at fuel tank.

(4) Install fuel level gage (para 3-41d).

(5) Install duct covers (para 5-3).

(6) Install exhaust pipes in storage compartment (para 2-6).

(7) Install duct assemblies (para 3-12e).

(8) Connect power cable (para 2-6g).

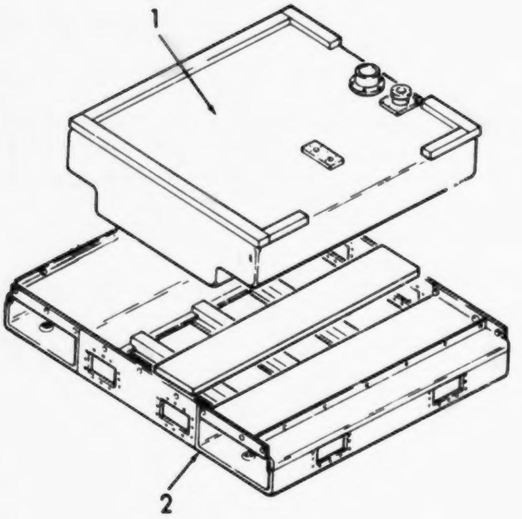


Figure 5-5. Fuel Tank, Installation.

APPENDIX A

REFERENCES

A-1. SCOPE.

This appendix lists all forms, technical manuals, and miscellaneous publications referenced in this manual.

A-2. FORMS.

Equipment Inspection and Maintenance Worksheet	DA Form 2404
Recommended Changes to Publications and Blank Forms	DA Form 2028
Recommended Changes to DA Publications	DA Form 2028-2
Quality Deficiency Report	SF-368

A-3. TECHNICAL MANUALS.

Administrative Storage	TM 740-90-1
Destruction of Army Materiel	TM 750-244-3
Painting Instructions for Army Materiel	TM 43-0139
The Army Maintenance Management System	DA PAM 738-750

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. INTRODUCTION.

a. This section provides a general explanation of all maintenance and repair functions authorized at the various maintenance levels.

b. The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or components will be consistent with the capacities and capabilities of the designated maintenance categories.

c. Section III lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from Section II.

d. Section IV contains supplemental instructions and explanatory notes for a particular maintenance function.

B-2. MAINTENANCE FUNCTIONS.

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel).

b. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or lectrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontamination, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e. Aline. To adjust specified variable elements of an item to bring about optimum performance.

B-2. MAINTENANCE FUNCTIONS - Continued.

f. Calibrate. To determine and cause corrections to be made or to be adjusted to instruments or test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. To remove and unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and is shown as the 3rd position code of the SMR code.

i Repair. The application of maintenance services [1], including fault location/troubleshooting [2], removal/installation, and disassembly/assembly [3] procedures, and maintenance actions [4] to identify troubles, and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly) end item, or system.

B-3. EXPLANATION OF COLUMNS IN THE MAC, SECTION II.

a. Column 1, Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly. End item group numbers shall be "00".

b. Column 2, Component/Assembly. Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

---

[1] Services - Inspect, test, service, adjust, aline, calibrate, and/or replace.

[2] Fault locate/troubleshoot - The process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or unit under test (UUT).

[3] Disassemble/Assemble - Encompasses the step-by-step taking apart (or breakdown) of a spare/functional group coded item to the level of its least componency identified as maintenance significant (i.e., assigned an SMR code) for the category of maintenance under consideration.

[4] Actions - Welding, grinding, riveting, straightening, facing, remachining, and/or resurfacing.

c. Column 3, Maintenance Function. Column 3 lists the functions to be performed on the item listed in Column 2. (For a detailed explanation of these functions, see paragraph B-2).

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the category of maintenance authorized to perform the function that maintenance function at the indicated category of maintenance. If the number or complexity of task within a listed maintenance function vary at different maintenance categories, appropriate work time figures will be shown for each category. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time, troubleshooting/fault location time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. The symbol designations for the various maintenance categories are as follows:

C.........Operator or crew
O.........Organizational Maintenance
F.........Direct Support Maintenance
H.........General Support Maintenance
L.........Specified Repair Activity (SRA)[5]

e. Column 5, Tools and Equipment. Column 5 specifies, by code, those common tool sets (not individual tools) and special tools, TMDE, and support equipment required to perform the designated function.

f. Column 6, Remarks. This column shall, when applicable, contain a letter code, in alphabetic order, which shall be keyed to the remarks contained in Section IV.

B-4. EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS, SECTION III.

a. Column 1, Reference Code. The tool and test equipment reference code correlates with a code used in the MAC, Section II, Column 5.

---

[5] This maintenance category is not included in Section II, column (4) of the Maintenance Allocation Chart. To identify functions to this category of maintenance, enter a work time figure in the "H" column of Section II, column (4), and use an associated reference code in the Remarks column (6). Key the code to Section IV, Remarks, and explain the SRA complete repair application there. The explanatory remark(s) shall reference the specific Repair Parts and Special Tools List (RPSTL) TM which contains additional SRA criteria and the additional spare/repair parts.

B-4. EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS, SECTION III - Continued.

b. Column 2, Maintenance Category. The lowest category of maintenance authorized to use the tool or test equipment.

c. Column 3, Nomenclature. Name or identification of the tool or test equipment.

d. Column 4, National Stock Number. The national stock number of the tool or test equipment.

e. Column 5, Tool Number. The manufacturer's part number.

B-5. EXPLANATION OF COLUMNS IN REMARKS, SECTION IV.

a. Column 1, Reference Code. The code recorded in column 6, Section II.

b. Column 2, Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section III.

Section II. MAINTENANCE ALLOCATION CHART

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			C	O	F	H	D		
00	HEATER, DUCT TYPE, PORTABLE, HDU-36/E 120,000 BTU/HR								
	Air Filter	Inspect	.1						
		Service	.2						
		Replace		.2					
	Exhaust Pipe	Inspect	.2						
		Replace		.2					
	Duct Assemblies	Inspect	.2						
		Repair		.3					
		Replace		.2					
01	CABINET ASSEMBLY	Inspect	.3						
		Repair			.8				
		Replace				1.0		1	

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			C	O	F	H	D		
02	CONTROL PANEL	Inspect	.3						
		Repair		1.3				1	
		Replace			1.5			1	
	Rotary Switch	Inspect	.2						
		Test		.3				2	
		Replace		.5				1	
	Fuel Pressure Gage	Inspect	.2						
		Replace		.3				1	
	Hour Meter	Inspect	.2						
		Replace		.3				1	
	Safety Switch Control Assembly	Inspect	.2						
		Repair		.5				1	
		Replace		.4				1	
	Audible Alarm	Inspect	.2						
		Replace		.4				1	
	Circuit Breaker	Inspect	.2						
		Test		.2				2	
		Replace		.5				1	
	Toggle Switch	Inspect	.2						
		Replace		.4				1	
	Rectifier	Inspect	.1						
		Test		.4				2	
		Replace		.4				1	
	3-Way Ball Valve	Inspect	.2						
		Replace		.3				1	
03	BLOWER, PUMP, AND MOTOR ASSEMBLY								
	Blower	Inspect	.2	.3					
		Service	.2						
		Replace			1.0			1	
	Pump	Inspect	.1	.2					
		Adjust		.3				1	
		Test			.4			1,2	
		Replace			.8			1	

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			C	O	F	H	D		
	Motor	Inspect	.1	.2					
		Service		.2					
		Test			.6			1,2	
		Repair			1.5			1	
		Replace			1.0			1	
04	ELECTRICAL INSTALLATION								
	Transformer Assembly	Inspect	.2						
		Test		.4				1,2	
		Replace		.7				1	
	Thermostat High Temperature Safety	Inspect	.2						
		Test		.5				1,2	
		Replace		.5				1	
	Controller Heater Temperature	Inspect	.2						
		Replace		.5				1	
	Power Cable Assembly	Inspect	.2						
		Repair		.4				1	
		Replace		.5				1	
	High Tension Cable Assembly	Inspect	.2						
		Repair		.4				1	
		Replace		.6				1	
	Discharge Temperature Thermostat	Inspect	.2						
		Test		.5				1,2	
		Replace		.5				1	
	Return Temperature Thermostat	Inspect	.2						
		Test		.5				1,2	
		Replace		.5				1	
05	TUBING INSTALLATION								
	Tube Assemblies	Inspect	.4						
		Replace		1.3				1	
	Solenoid Valves	Inspect	.4						
		Test		.4				1,2	
		Replace		1.0				1	
	Filter, Fuel Oiler	Inspect	.2						
		Repair		.5				1	
		Replace		.8				1	

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			C	O	F	H	D		
	Sight Glass	Inspect	.2						
		Service	.2						
		Replace		.5				1	
06	BURNER ASSEMBLY								
	Flame Detector	Inspect		.2					
		Replace		1.0				1	
	Electrodes	Inspect		.2					
		Replace		1.0				1	
	Nozzle	Inspect		.2					
		Replace		.9				1	
07	HEAT EXCHANGER ASSEMBLY								
	Combustion Air Hose	Inspect	.1						
		Replace		.4				1	
	Sightglass Hose	Inspect	.1						
		Replace		.4				1	
	Heat Exchanger	Inspect			.3				
		Replace				1.8		1	
		Test				.5		4	
08	FRAME ASSEMBLY								
	Liquid Level Gauge	Inspect	.2						
		Replace		.4				1	
	Fuel Tank	Inspect	.2						
		Service	.5						
		Replace				3.0			
	Lifting Handles	Inspect	.2						
		Replace		1.0				1,3	
	Skid	Inspect		.2					
		Repair			1.0			1	
		Replace				3.0		1	

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

(1) Reference Code	(2) Maintenance Level	(3) Nomenclature	National/Nato Stock Number	Tool Number
1	C, O, F, H	Tool Kit, General Mechanic's	5180-00-177-7033	
2	O, F	Multimeter, AN/PSM	6625-01-139-2515	
3	O	Riveter, Blind, Hand	5120-00-017-2247	
4	H	Carbon Monoxide Tester	6665-00-957-4807 or equivalent	

Section IV. REMARKS

NONE

APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

C-1. SCOPE.

This appendix lists components of end item and basic issue items for the heater unit to help you inventory items required for safe and efficient operation.

C-2. GENERAL.

The Components of End Item and Basic Issue Items List are divided into the following sections:

a. Section II. Components of End Item. This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the end item, but are removed separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between properly accounts. Illustrations are furnished to assist you in identifying the items.

b. Section III. Basic Issue Items. These are the minimum essential items required to place the heater unit in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the heater unit during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end item.

C-3. EXPLANATION OF COLUMNS.

The following provides an explanation of columns found in the tabular listing:

a. Column (1) - Illustration Number (Illus. Number). This column indicates the number of the illustration in which the item is shown.

b. Column (2) - National Stock Number. Indicates the national stock number assigned to the item and will be used for requisitioning purposes.

c. Column (3) - Description. Indicates the Federal item and name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.

d. Column (4) - Unit of Measure (U/M). Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g.; ea, in, pr).

e. Column (5) - Quantity required (Qty rqr). Indicates the quantity of the item authorized with/on the equipment.

Section II. COMPONENTS OF END ITEM

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM AND PART NUMBER	(3) USABLE ON CODE	(4) U/M	(5) QTY RQR
		DUCT, RETURN AIR (98752) 12006-100		EA	1
		DUCT, SUPPLY AIR (98752) 12006-101		EA	1

Section III. BASIC ISSUE ITEMS

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM AND PART NUMBER	(3) USABLE ON CODE	(4) U/M	(5) QTY RQR
		TM 5-4520-256-14 OPERATOR'S, UNIT, AND INTERMEDIATE DIRECT AND GENERAL SUPPORT MAINTENANCE MANUAL		EA	1
		TM 5-4520-256-24P UNIT AND INTERMEDIATE DIRECT AND GENERAL SUPPORT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LIST		EA	1

APPENDIX D

ADDITIONAL AUTHORIZATION LIST

Section I. INTRODUCTION

D-1. SCOPE.

This appendix lists additional items you are authorized for the support of the heater unit.

D-2. GENERAL.

This list identifies items that do not have to accompany the heater unit and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.

D-3. EXPLANATION OF LISTING.

National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type document (i.e., CTA, MTOE, TDA, or JTA) which authorizes the item(s) to you.

Section II. ADDITIONAL AUTHORIZATION LIST (AAL)

NONE AUTHORIZED

APPENDIX E

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

E-1. SCOPE.

This appendix lists expendable supplies and materials you will need to operate and maintain the heater unit. These items are authorized to you by CTA 50-970, Expendable/Durable Items (except Medical, Class V, Repair Parts and Heraldic Items), or CTA 8-100, Army Medical Department.

E-2. EXPLANATION OF COLUMNS.

a. Column 1 - Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use sealing compound, Item 6, Appendix E").

b. Column 2 - Category. This column identified the lowest category of maintenance that required the listed item:

C - Operator/Crew
O - Organizational
F - Direct Support
H - General Support

c. Column 3 - National Stock Number. This is the national stock number assigned to the item; use it to request or requisition the item.

d. Column 4 - Description. Indicates the federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parenthesis, if applicable.

e. Column 5 - Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the lowest unit of measure differs from the rest of the issue, requisition the lowest unit of issue that will satisfy your requirements.

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Category	(3) National Stock Number	(4) Description	(5) U/M
1	H		Adhesive, Silastic, RTV 732	
2	0	8020-00-205-1711	Brush, Medium Bristle	EA
3	0		Cleaner, Glass	
4	F		Paint, MIL-C-46168, Type II	
5	F		Paper, Abrasive, P-P-101	
6	0		Permalock LH 150	
7	0		Preservative, P-9, VV-L-800	
8	F		Primer, Aluminum, MIL-P-53022	
9	F		Primer, Steel, MIL-P-52192	
10	0	7930-00-068-1669	Soap, Mild	GAL
11	0	6850-00-274-5421	Solvent, Cleaning, P-D-680	GAL
12	F		Tape, Masking, UU-T-106	
13	0		Tape, Pressure Sensitive, PPP-T-66	
14	0		Trichloroethane, O-T-620	
15	C		Diesel Fuel, FED SPEC VV-F-800 or Jet Fuel (JP-4), FED SPEC MIL-T-5624	

APPENDIX F

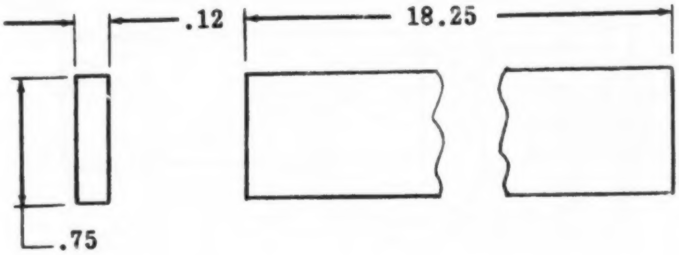
ILLUSTRATED LIST OF MANUFACTURED ITEMS

F-1. INTRODUCTION.

This appendix includes complete instructions for making items authorized to be manufactured or fabricated at organizational maintenance. A part number index in alphanumeric order is provided for cross-referencing the part number of the item to be manufactured to the figure which covers the fabrication criteria. All bulk materials needed for manufacture of an item are listed by part number or specification number in a tabular list on the illustration.

F-2. MANUFACTURED ITEMS PART NUMBER INDEX.

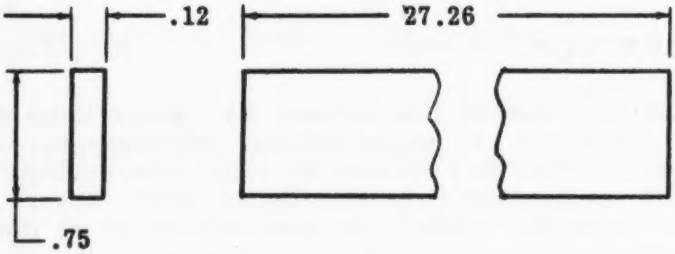
Part Number	Figure Number
8612008-1	F-6
8612038-2	F-5
8720650/18	F-3
8720668/2	F-4
8720717/5	F-2
8720717/6	F-1



Notes:

1. Make from gasket material, part number 4111N.

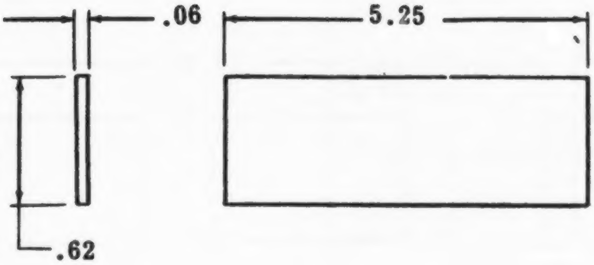
Figure F-1. Door Gasket.



Notes:

1. Make from gasket material, part number 4111N.

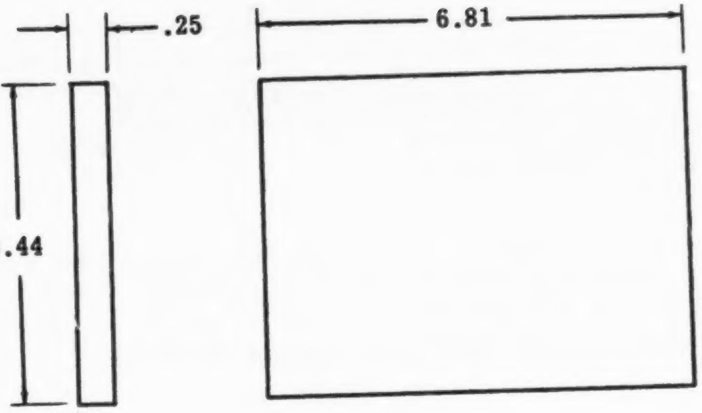
Figure F-2. Door Gasket.



Notes:

1. Make from gasket material, part number 4111N.

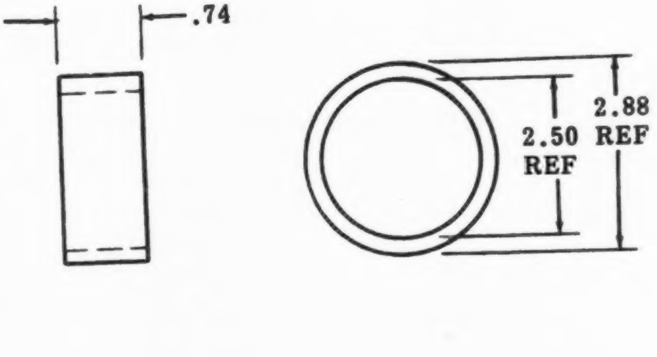
Figure F-3. Terminal Cushion.



Notes:

1. Make from gasket material, part number 4111N.

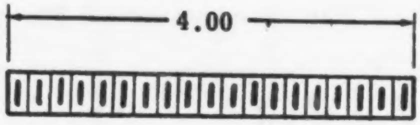
Figure F-4. Transformer Cushion.


.74
2.50
REF
2.88
REF

Notes:

1. Make from hose material, part number 4169A.

Figure F-5. Air Plenum Hose.



Notes:

1. Make from threaded rod, part number 98804A029.

Figure F-6. Support Rod.

APPENDIX G

TORQUE LIMITS

CAUTION

The following torque values are derived from oil free cadmium plated threads.

	Torque Limits (Recommended for installation) (Bolts Loaded Primarily in Shear)		Maximum Allowable Tightening Torque Limits	
Tap Size	Tension Type Nuts MS20365 and AN310 (40,000 PSI in Bolts)	Shear Type Nuts MS20364 and AN320 (24,000 PSI in Bolts)	Nuts MS20365 and AN310 (90,000 PSI in Bolts)	Nuts MS20364 and AN320 (54,000 PSI in Bolts)
		FINE THREAD SERIES		
8-36	12-15	7-9	20	12
10-32	20-25	12-15	40	25
1/4-28	50-70	30-40	100	60
5/16-24	100-140	60-85	225	140
3/8-24	160-190	95-110	390	240
7/16-20	450-500	270-300	840	500
1/2-20	480-690	290-410	1100	660
9/16-18	8000-1000	480-600	1600	960
5/8-18	1100-1300	600-780	2400	1400
3/4-16	2300-2500	1300-1500	5000	3000
7/8-14	2500-3000	1500-1800	7000	4200
1-14	3700-5500	2200-3300*	10,000	6000
1-1/8-12	5000-7000	3000-4200*	15,000	9000
1-1/4-12	9000-11,000	5400-6600*	25,000	15,000
		COARSE THREAD SERIES		
8-32	12-15	7-9	20	12
1-24	20-25	12-15	35	12
1/4-20	40-50	25-30	75	45
5/16-18	80-90	48-55	160	100
1/8-16	150-185	95-100	275	170
7/16-14	235-255	140-155	475	280
1/2-13	400-480	240-290	880	520
9/16-12	500-700	300-420	1100	650
5/8-11	700-900	420-540	1500	900
3/4-10	1150-1600	700-950	2500	1500
7/8-9	2200-3000	1300-1800	4600	2700

The above torque values may be used for all cadmium-plated steel nuts of the fine or coarse thread series which have approximately equal number of threads and equal face bearing areas.

*** ESTIMATED CORRESPONDING VALUES**

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WIRE RUN NO. △19	WIRE SIZE OR ITEM NO.	WIRE COLOR	STRIP INSUL ±.06	TERM LUG ITEM NO.	FROM	TO	STRIP INSUL ±.06	TERM. LUG ITEM NO.	WIRE LENGTH (INCHES) +2.00 -0.00	REMARKS
X1A12N	106	WHITE	.34	96	TB1-1	S1-1	.34	99	27	
X2A12N	106		.34	99	S1-2	TB1-3	.34	96	22	
X2B12N	106		.34	99	S1-2	S1-3	.34	99	2	
X3A12V	106		.34	96	TB1-2	CB1-2	.34	96	26	
X4A12V	106		.34	96	CB1-1	S1-5	.34	99	7.25	
X4B12V	106		.34	99	S1-5	S1-9	.34	99	2	
			.25	94	S1-6	T1				SELF-LEAD
X5B12V	106		.34	99	S1-6	S1-7	.34	99	2	
X5C12V	106		.34	99	S1-7	B1	.62	103	57	
X5A16V	107		.25	100	S1-7	S7-1	.25	93	5	
					T1-LO-V	TB1-4	.25	92		SELF-LEAD
X7A16V	86		-	-	T1	E1	-	-		
X8A16V	86		-	-	E1	T1-HI-V	-	-		
X9A16N	107		.25	98	T1-CTR	GND	.25	95	47	
X10A12N	106		.62	103	B1	TB1-3	.34	96	29	
			.25	92	TB1-4	L2				SELF-LEAD
			.25	115	S7-2	L2				
X15C16V	107		.25	100	S1-11	R1AC	.28	97	35	
X15A16V	107		.25	100	S1-11	P2-A	.18	104	10	
X15B16V	107		.25	100	S1-11	TC-1	.25	93	35	
X16A16V	107		.18	104	P2-C	TC-7	.25	93	21	
X16B16V	107		.18	102	J2-C	K8-B	.18	98	10.50	
X17A16V	107		.25	93	TC-8	P2-D	.18	98	13	
X17B16V	107		.18	102	J2-D	K8-W	.25		10	
X18A16V	107		.18	104	P2-F	TB1-12	.25	98	17	
X18B16V	107		.18	102	J2-F	K8-F1	.25		9	
X19A16V	107		.18	104	P2-H	S2	.28	97	35	
X19B16V	107		.18	102	J2-H	K8-F2	.18	98	9.50	
					D1	TB1-11	.25	92		SELF-LEAD
X21A16V	107		.28	97	S2	TB1-11	.25	98	41	
X22A16N	107		.18	104	P2-E	TB1-5	.25	98	15	
X23A16V	107		.18	104	P2-K	TB1-9	.25	98	15	
			.18	104	P2-B	EM1+				SELF-LEAD
					L1	TB1-8	.25	92		SELF-LEAD
					EM1-	TB1-6	.25	92		SELF-LEAD
X27A16N	107		.25	93	TC-2	TB1-6	.25	98	10	
					L1	TB1-9	.25	92		SELF-LEAD
X30A12N	106		.34	99	B1-G	GND	.34	101	30	
					TT	R1+ DC	.28	97		SELF-LEAD
			.28	97	R1-DC	TT-				SELF-LEAD
X36A16N	107	WHITE	.28	97	R1ACN	TB1-7	.25	98	35	
					D1	TB1-12	.25	92		SELF-LEAD
6 TERMINAL JUMPER	107				TB1-3 THRU TB1-8					
POWER CORD	59	BLACK			P1	TB1-2				
	59	WHITE			P1	TB1-1				
	59	GREEN			P1	GND				
-	-	-			TS1	TC-3	.25	115		SELF LEAD
-	-	-			TS1	TC-4	.25	115		SELF LEAD
-	-	RED YELLOW	-	-	K8(BLACK)	J2-A	.18	102		SELF-LEAD
-	-	BLACK	-	-	K8(WHITE)	J2-E	.18	102		SELF-LEAD
-	-	WHITE	-	-	K8(ORANGE)	J2-K	.18	102		SELF-LEAD
-	-	ORANGE	-	-	K8(RED/YELLOW)	J2-B	.18	102		SELF-LEAD
					TS2	TC-5	.25	115		SELF-LEAD
					TS2	TC-6	.25	115		SELF-LEAD

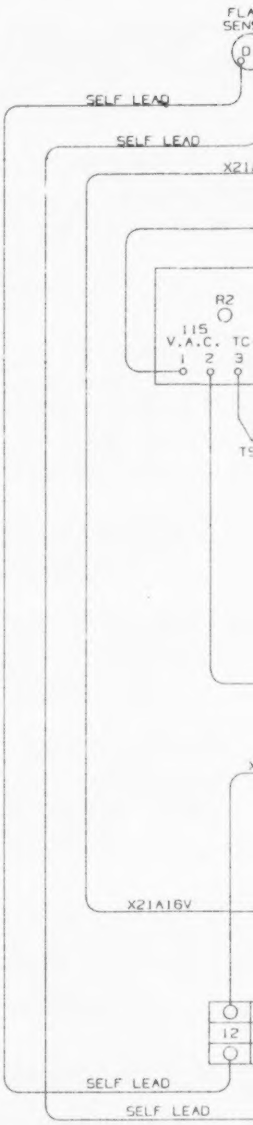
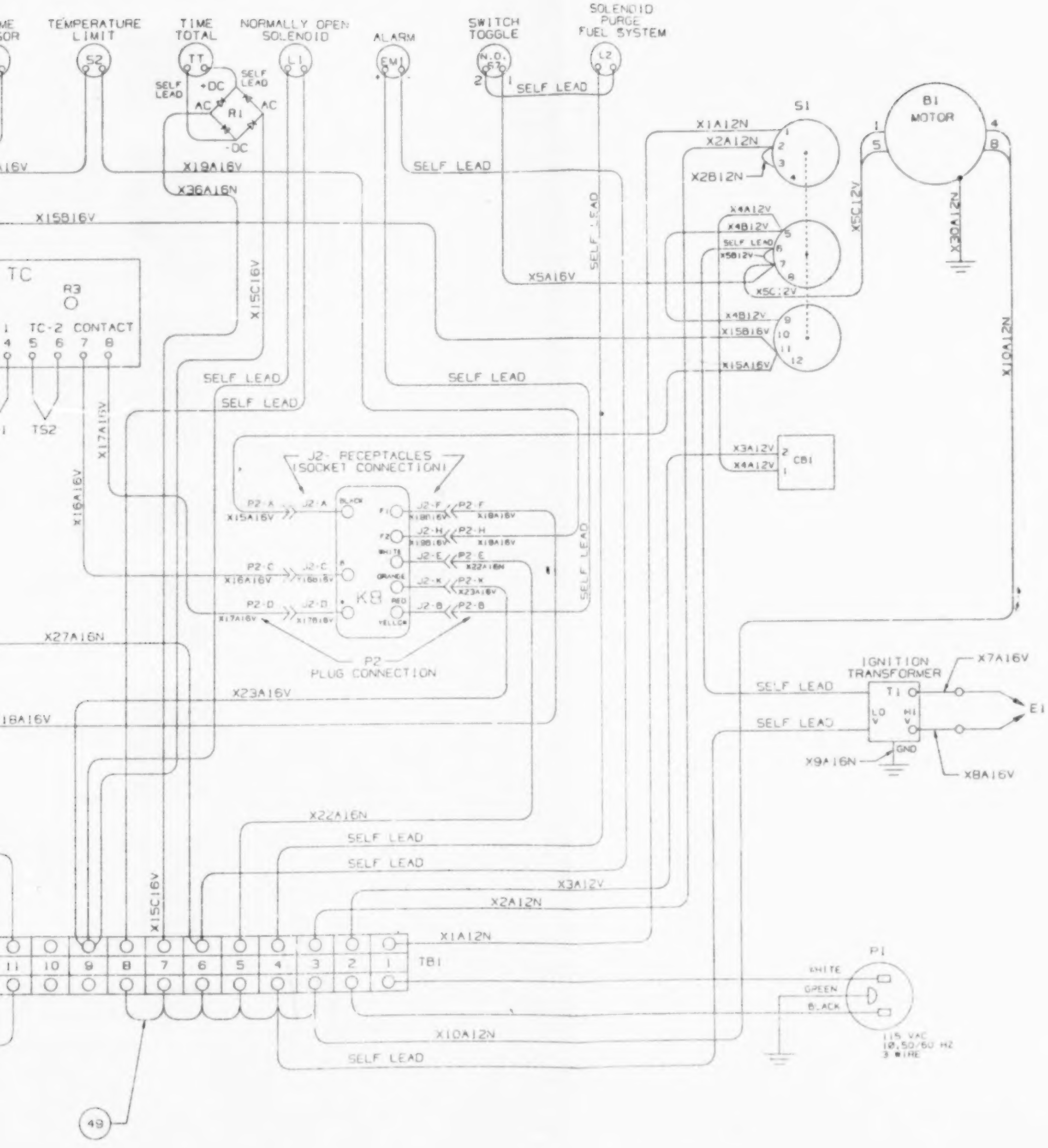


Figure FO-1.


ME
SOR
TEMPERATURE LIMIT
S2
TIME TOTAL
TT
NORMALLY OPEN SOLENOID
L1
ALARM
EM1
SWITCH TOGGLE
N.O.
SOLENOID PURGE FUEL SYSTEM
L2
SELF LEAD
+DC
-DC
AC
R1
S1
B1 MOTOR
X1A12N
X2A12N
X2B12N
X4A12V
X4B12V
X5B12V
X5C12V
X15B16V
X15A16V
X30A12N
X10A12N
X5A16V
X19A16V
X36A16N
X15C16V
X17A16V
X16A16V
TC
R3
TC-2 CONTACT
TS2
J2- RECEPTACLES (SOCKET CONNECTION)
P2-A
J2-A
P2-C
J2-C
P2-D
J2-D
J2-F
P2-F
J2-H
P2-H
J2-E
P2-E
J2-K
P2-K
J2-B
P2-B
BLACK
WHITE
ORANGE
RED
YELLOW
K8
X18A16V
X18B16V
X19B16V
X16B16V
X17B16V
X22A16N
X23A16V
P2 PLUG CONNECTION
X27A16N
X18A16V
CB1
X3A12V
X4A12V
IGNITION TRANSFORMER
T1
LO V
HI V
GND
X7A16V
X8A16V
X9A16N
E1
X2A12N
TB1
11
10
9
8
7
6
5
4
3
2
1
P1
WHITE
GREEN
BLACK
115 VAC 1Ø,50/60 HZ 3 WIRE
49

Viring Diagram.

By Order of the Secretaries of the Army, the Navy, and the Air Force:

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Chief of Staff

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PFC JOHN DOE
COA, 3d ENGINEER BN
FT. LEONARDWOOD, MO 63108

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 5-4520-256-14	5 Aug 1988	Heater, Duct Type, Portable, HDU-36/E, 120,000 BTU

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO	IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:
6	2-1 a			In line 6 of paragraph 2-1a the manual states the engine has 6 Cylinders. The engine on my set only has 4 Cylinders. Change the manual to show 4 Cylinders.
81		4-3		Callout 16 on figure 4-3 is pointing at a bolt. In key to figure 4-3, item 16 is called a shim - Please correct one or the other.
125	line 20			I ordered a gasket, item 19 on figure B-16 by NSN 2910-00-762-3001. I got a gasket bit it doesn't fit. Supply says I got What I ordered, so the NSN is Wrong. Please give me a good NSN

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER	SIGN HERE
JOHN DOE, PFC (268) 317-7111	John Doe JOHN DOE

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The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*
inches	centimeters	2.540
feet	meters	.305
yards	meters	.914
miles	kilometers	1.609
square inches	square centimeters	6.451
square feet	square meters	.093
square yards	square meters	.836
square miles	square kilometers	2.590
acres	square hectometers	.405
cubic feet	cubic meters	.028
cubic yards	cubic meters	.765
fluid ounces	milliliters	29,573
pints	liters	.473
quarts	liters	.946
gallons	liters	3.785
ounces	grams	28.349
pounds	kilograms	.454
short tons	metric tons	.907
pound-feet	newton-meters	1.356
pound-inches	newton meters	.11296

To change	*To*	*Multiply by*
ounce-inches	newton-meters	.007062
centimeters	inches	.394
meters	feet	3.280
meters	yards	1.094
kilometers	miles	.621
square centimeters	square inches	.155
square meters	square feet	10.764
square meters	square yards	1.196
square kilometers	square miles	.386
square hectometers	acres	2.471
cubic meters	cubic feet	35.315
cubic meters	cubic yards	1.308
milliliters	fluid ounces	.034
liters	pints	2.113
liters	quarts	1.057
liters	gallons	.264
grams	ounces	.035
kilograms	pounds	2.205
metric tons	short tons	1.102

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

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